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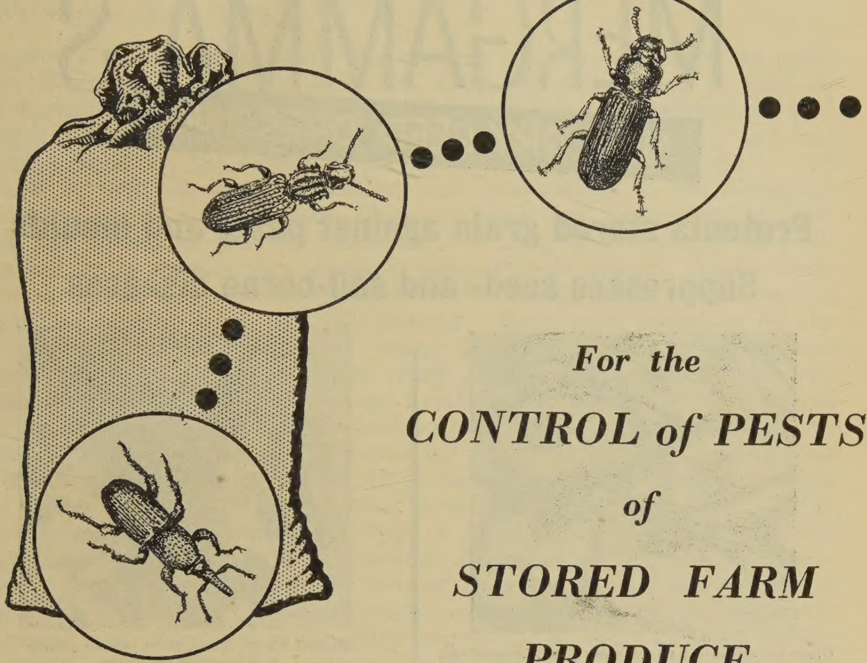

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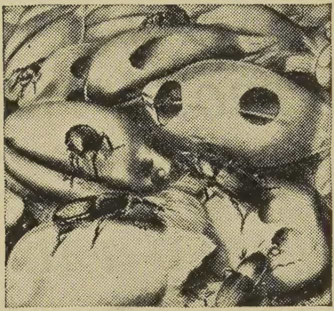
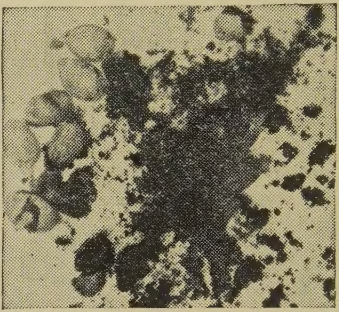


Grain weevils eating stored grain (much magnified).



Bunted wheat. Black spore masses clearly visible within the grain.

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Protects these crops against these diseases

WHEAT	Bunt
BARLEY	Covered smut · Leaf stripe · Net blotch
RYE	Bunt · Stripe smut
OATS	Covered and loose smuts · Leaf stripe
RICE	Foot rot · Leaf spot
MAIZE	Dry rot
SORGHUM	Kernel smut · Leaf spot
GROUND-NUTS	Black rot · Foot rot
JUTE	Stem rot
SUGAR BEET	Black leg

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Todd (D. H.). **A preliminary Account of *Dasyneura mali* Kieffer (Cecidomyidae: Dipt.), and an associated Hymenopterous Parasite in New Zealand.**—*N.Z. J. Sci. Tech.* **37** (A) no. 5 pp. 462–464, 6 refs. Wellington, N.Z., 1956.

Dasyneura mali (Kieff.), which has recently become established on apple in New Zealand [*cf. R.A.E.*, A **41** 287, 410], was found early in 1954–55 to be parasitised by *Prosactogaster demades* (Wlk.), a Platygasterid that was earlier tentatively identified as *Misocyclops marchali* Kieff., and had been introduced for the control of *D. pyri* (Bch.) [*cf.* **23** 678, etc.]. All stages of *D. mali* are briefly described, and observations on the bionomics of the two insects are recorded. These showed that feeding by *D. mali* causes the leaves to roll and sometimes to drop prematurely; terminal leaves and water sprouts were the most susceptible to attack. Apple stocks in some nurseries were severely stunted by the Cecidomyiid in 1954–55, but the yield of bearing trees was not affected. Eggs were deposited on the upper surfaces of the margins of young leaves early in the season and indiscriminately over the leaf when plant growth was less rapid and oviposition sites restricted. The average number of larvae per rolled leaf was 265·5 on leaves averaging 4·5 cm. in length in February and 92·8 on those averaging 3·8 cm. in April. The larvae fed for about three weeks and then pupated in the soil or, occasionally, in sheltered places on the tree or within rolled leaves. Mature field-collected larvae gave rise to adults in the laboratory after a minimum pupal stage of 14 days, and the latter survived in cages for only a few days. The number of generations a year is unknown.

Adults of *P. demades* emerged two or three days later than those of *D. mali*. The eggs were usually deposited in the abdomen of the host larva, but several were often laid in the same individual, as many as seven having been found, and some then occurred in the thorax. Embryonic development was prolonged, and free larvae were not found until the host began to spin its cocoon. The larvae then became fully fed within a few days, having entirely consumed the host. In 1955, the percentages of parasitism and (in brackets) superparasitism amounted to 66 (10) per cent. in mid-January, 37 (9) and 27 (about 5) in early February, and 66 (29) at the end of March.

Kirkpatrick (T. W.). **Insect Life in the Tropics.**—8¾ × 5½ ins., xiv + 311 pp., 146 figs. London, &c., Longmans, Green & Co., 1957. Price £1 15*s*.

This book comprises a largely non-technical account of insects and their habits for those living in the tropics, and most of the examples given are drawn from the author's experience in East Africa and Trinidad. There are ten chapters, dealing with the tropical environment in general, classification, development, reproduction, locomotion, food and feeding habits, defence and protection, insects that live in communities, and the nests made by termites, ants, bees and wasps. The emphasis is not primarily economic, but many of the insects chosen as examples are injurious in various ways or beneficial.

Brandt (H.). **Welcher Schädling ist das? Schädlinge und Krankheiten an Gemüse und Obst.** [What Pest is that? Pests and Diseases of Vegetables and Fruit.]—Kosmos-Naturführer, 210 pp., 8 col. pls., text illus. Stuttgart, Franckh'sche Verlagshandl., 1957. Price *DM.* 11.80. cloth; *DM.* 9.80 paper cover.

The information in this compendium for growers of vegetables and fruits in Germany is arranged in condensed tabular form. Medicinal plants are included with the vegetables, and the fruits comprise pip and stone fruits, bushes, vines and nuts. Many of the pests dealt with are insects or other arthropods, and the diseases include those caused by insect-borne viruses, for which the vectors are shown. The tables are arranged under the plants concerned and subdivided according to plant part, and they show the nature of the damage caused, the German and scientific names of the pests or disease agents, their appearance and habits, where appropriate, and the recommended control measures. Most of the pests are figured, and indications are given as to which are of major importance. Notes on insecticides and explanations of miscellaneous terms used in chemical control are appended in a glossary.

HAEGERMARK (U.). **Undersökning av frekvensen perforeringar på fruktämnen och skidor i två höstrapsodlingar.** [Investigations on the Frequency of Perforation of Ovaries and Pods in two Fields of Autumn Rape.]—*Växtskyddsnotiser* 1956 no. 3 pp. 45–47, 2 graphs. Stockholm, 1956.

In view of interest in the relation of the holes made in rape pods by *Ceutorhynchus assimilis* (Payk.) to oviposition by *Dasyneura brassicae* (Winn.) [*cf. R.A.E.*, A **45** 206], observations were made in two fields of autumn-sown rape in Sweden. It was found that punctures were made in the ovaries, before the petals fell, as well as in the pods, and that their frequency varied directly with the size of the weevil population. If all the perforations found were made by the weevil, their number was very high in comparison with weevil numbers, so that if the Cecidomyiid used all the holes for oviposition, even a small weevil population would permit heavy infestation by it.

HURPIN (B.). **Sur une "maladie laiteuse" des larves de** ***Melolontha melolontha*** **L. (Coléopt. Scarabeidae).**—*C.R. Soc. Biol.* **149** (1955) no. 21–22 pp. 1966–1967, 5 refs. Paris, 1956.

Third-instar larvae of *Melolontha melolontha* (L.) collected in meadowland in the department of Oise in July 1950 and that of Seine-Maritime in August 1953 showed symptoms resembling those of the milky disease of *Popillia japonica* Newm. caused by *Bacillus popilliae* in the United States [*cf. R.A.E.*, A **29** 369], and sporulating bacteria resembling *B. popilliae* were found in them. Such a disease was not previously known to occur in Europe. The haemolymph of diseased larvae proved infective for healthy ones inoculated with 1 cu. mm. and tests were carried out in the laboratory on the infectivity of spores preserved in dried smears or in sealed suspensions when added to food or soil. Second- and third-instar larvae were placed separately in soil together with a slice of carrot soaked for an hour in the liquid obtained by washing the smears, the carrot being renewed after a week, and untreated slices were also provided as additional food. The results showed that the effects were much more rapid at 25°C. [77°F.] than at 16°C. [60·8°F.]. Third-instar larvae were more susceptible than second-instar ones, though complete mortality was not attained, and symptoms in third-instar larvae appeared in 18 days at 25°C. and in 22 at 16°C.; in one test at 25°C., ten third-instar individuals died from the disease in 40 days. Similar results were obtained by watering soil rich in humus with suspensions of the spores, but there was no appreciable result in sandy or clay soils.

FERON (M.), SCHVESTER (D.) & GUENNELON (G.). **Sur l'origine des attaques de la mouche méditerranéenne des fruits:** *Ceratitis capitata* **Wied. dans la vallée du Rhône.**—*C.R. Acad. Agric. Fr.* **42** no. 2 pp. 94–97. Paris, 1956.

In view of heavy infestation of fruits by *Ceratitis capitata* (Wied.) in the Rhône valley of France in 1949, investigations were made to ascertain whether the pupae of this fruit-fly can survive the winter there [*cf. R.A.E.*, A **42** 184] and the earliest time of year at which imported infested fruits left lying on the ground would give rise to adults.

In the first series of tests, pupae placed in lots of 100 in November 1952 and 1953 in a cellar in which the temperature varied from 3 to 12°C. [37·4 to 53·6°F.] showed mortality that increased with time and became complete at the end of December or during January. In field tests near Lyons, several thousand pupae were placed in the soil in different localities in 1951–54. All those exposed in October and November were dead by the end of November and December, respectively, and it was observed that mortality increased as the temperature fell to 4°C. [39·2°F.] and became complete before freezing point was reached. In the Avignon region, several thousand pupae were allowed to develop in the soil under cages in which infested fruits had been placed in November 1952. No adults emerged after the winter, and all the pupae recovered were dead. Other lots placed in the soil in varying conditions were all dead from the end of March, and 5 per cent. were found to have been parasitised by *Aphaereta minuta* (Nees).

In the second series of tests, laboratory-reared females were allowed to oviposit in oranges and the latter were subsequently exposed in the open under cages. In 1953, the first adults developed on 7th June from oranges that contained eggs on 18th April. In 1954, when the experiments were begun in February, the first to emerge did so on 8th and 15th June from oranges containing larvae on 5th May and 30th April, respectively, and in 1955 they did so on 15th May, from oranges that contained larvae on 12th April. Later in the season, the periods before emergence became progressively shorter.

It is concluded that *C. capitata* is unlikely to be established in the Rhône valley, and that, even if it could overwinter in isolated instances, imported fruits are the main source of infestation each year.

ERNOULD (L.). **Résultats obtenus dans la lutte contre la jaunisse de la betterave en Belgique par traitements aux insecticides systémiques.**—*Publ. tech. Inst. belge Amélior. Better.* **23** no. 3 pp. 147–223, 3 fldg. tables, refs. Tirlemont, 1955. (With Summaries in Flemish & English.)

Details are given of 18 field tests carried out in different parts of Belgium in 1950–55 on the effectiveness of spraying with systemic insecticides against Aphids in protecting sugar-beet from the virus-yellows disease transmitted by them. The systemic insecticides tested were mainly schradan, demeton (diethyl 2-(ethylthio)ethyl phosphorothioate) and methyl-demeton (dimethyl 2-(ethylthio)ethyl phosphorothioate), and they were compared with several non-systemic insecticides. The systemic materials proved very effective against the Aphid vectors (*Myzus persicae* (Sulz.) and *Aphis fabae* Scop.), demeton and methyl-demeton being more rapid in action than schradan and giving almost complete kill at 0·225 and 0·45 lb. active ingredient per acre, respectively, and all were more effective than the non-systemic insecticides. Two applications a fortnight apart prevented reinfestation, but resulted in insufficient reductions in virus infection, the best obtained (under conditions of high infection) not exceeding 50 per cent. [*cf. R.A.E.*, A **41** 93; **43** 160; **45** 382]. The systemic insecticides increased the yield of roots and their sugar content in some of the tests, especially in early-sown and late-harvested crops, whereas the other materials did not.

It is recommended as a result of the work that, in districts in which infection reaches 80 per cent. in mid-September, spraying with a systemic insecticide should be begun as soon as counts of *M. persicae* show an average of 0·5 per plant. Where infestation is less heavy, it can be postponed until the counts show 1–2 Aphids per plant, but the economic value of treatment in such areas is hard to predict.

Jørgensen (J.). **Den store kålflue** (*Chortophila floralis* **Fall.). Nyere undersøgelser vedrørende dens biologi, parasitering og bekaempelse.** [The Large Cabbage Fly (*Hylemyia floralis*). New Investigations on its Biology, Parasites and Control.]—*Tidsskr. Planteavl* **60** pt. 4 pp. 657–712, 19 figs., 23 refs.; also as *Beretn. Forsøgsv. PlKult.* no. 533. Copenhagen, 1957. (With a Summary in English.)

Hylemyia (*Chortophila*) *floralis* (Fall.) has long been a pest of cruciferous crops in Denmark, especially on sandy soils in Jutland [*cf. R.A.E.*, A **42** 239]. Infestation was severe in 1952–54, when swedes were destroyed over large areas, and investigations on the bionomics and control of the Anthomyiid were therefore carried out. The preliminary results have already been noticed [*loc. cit.*]. There was only one generation a year, except at one locality in the north, where there were two, the adults of which emerged in June and August–September, respectively. Turnips were less severely attacked than swedes, and injury to cabbage was usually confined to the roots and lower part of the stalk, though damage to the heads occasionally occurred on white cabbage. The roots of horse-radish were severely injured at times. The most important parasite of *H. floralis* was the Cynipid, *Tribliographa* (*Cothonaspis*) *rapae* (Westw.), which developed in the larvae and pupae and had one generation a year, the adults emerging in August–November. The percentage parasitism was variable, but averaged 27·4 in 1953 and 36·3 in 1955. Some control of the pupae was afforded by the Staphylinid, *Aleochara bilineata* Gylh.

Tests with the insecticides used on swedes in 1952 [*loc. cit.*] were continued in 1953, but good control was given only by a 20 per cent. aldrin wettable powder applied as a dust along the rows at 45 lb. per acre in late June and by dilute sprays of aldrin and chlordane applied in late July. The aldrin dust treatment applied in late July failed in 1954, and dusts and sprays of DDT applied four times while the adults were present proved useless. Sprays of aldrin, heptachlor and Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] were tested in 1954 and 1955, during the oviposition period of *H. floralis*, for their effect on the newly hatched larvae, but the results were too erratic for conclusions to be drawn.

von Rosen (H.). **Eine phytophage** *Eurytoma* **in Mittel- und Nordschweden (Hym. Chalcid.).** [A phytophagous *Eurytoma* in central and northern Sweden.]—*Opusc. ent.* **21** pt. 1 pp. 16–20, 8 figs., 4 refs. Lund, 1956.

The Eurytomid found infesting wheat in Sweden and tentatively identified as *Harmolita noxialis* (Porch.) [*R.A.E.*, A **45** 120] was subsequently found to differ from that species. It is here described from adults of both sexes as *Eurytoma suecica*, sp.n., and characters are given distinguishing it from several related Eurytomids.

Sömermaa (K.). **Vitaxkvalstrens** *Siteroptes* (*Pediculoides*) *graminum* **Reut. skadegörelse i vetefält.** [Injury by *Pediculoides graminum* in Wheat Fields.]—*Växtskyddsnotiser* 1956 no. 4 pp. 52–59, 4 figs. Stockholm, 1956.

Detailed descriptions are given from observations in Sweden of the types of injury caused to autumn- and spring-sown wheat by *Pediculoides* (*Siteroptes*) *graminum* (Reut.).

Borg (Å.). **Massförekomst av tusenfotingar i växthus.** [Mass Occurrence of Millepedes in the Greenhouse.]—*Växtskyddsnotiser* 1956 no. 4 pp. 60–63, 1 fig. Stockholm, 1956.

An outbreak of *Paradesmus* (*Orthomorpha*) *gracilis* (Koch) occurred in July 1955 in a greenhouse at Tidaholm, Sweden, in which cucurbits were growing, and considerable damage resulted to the roots and root-collars of the plants, though some of it may have had other causes. Information on the life-history of the millepede is summarised from an earlier paper [*R.A.E.*, A **5** 459]. The damaged plants were removed by the grower, and the infested soil was subsequently watered with DDT, aldrin and BHC emulsion concentrates diluted in water. The results were somewhat inconclusive, as the soil dried out too much for normal survival of the millepedes, but aldrin appeared to give much the best control. In laboratory tests, good control was given by dusting the soil with 1 per cent. γ BHC and 20 per cent. aldrin at the rate of 0·3 oz. per sq. yard, and also by baits of moistened wheat bran to which suitable insecticides were added. Aldrin at 1 part 3 per cent. powder in 5 parts bran and a 45 per cent. parathion emulsion concentrate at 1 part in 200 parts bran were effective, though slow in action, but complete kill in one day was given by Paris green at 1:20.

Borg (Å.). **Ett bekämpningsförsök mot kålbladstekeln** (*Athalia colibri* **Christ.**) **vid ogynnsam väderlek.** [An Experiment on the Control of *Athalia rosae* in unfavourable Weather.]—*Växtskyddsnotiser* 1956 no. 5–6 pp. 71–75, 2 figs. Stockholm, 1956.

Although parathion is effective against *Athalia rosae* (L.) (*colibri* (Christ)) on cruciferous crops in Sweden, it is a dangerous insecticide, and less poisonous materials were therefore compared with it in a test on winter rape in the autumn of 1956. The weather was unfavourable for larval development, and infestation was thus generally light. Treatments were applied on 3rd October, and counts of living and dead larvae were made two days later. The mortality percentages averaged 99·6 for 45 per cent. parathion at 0·045 gal. per acre, 96·9 and 94·6 for 50 per cent. malathion at 0·18 and 0·09 gal., and 81·6 for a mixture of 25 per cent. DDT and 1·75 per cent. lindane [almost pure γ BHC] at 0·18 gal., all in sprays, and 93 for a dust of 1 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] at 18 lb. per acre, as compared with 0 for no treatment.

BRAMMANIS (L.). **Om barrträdskvalstret** (*Paratetranychus ununguis* **J.) och dess bekämpande.** [The Conifer Mite, *Oligonychus ununguis*, and its Control.]—*Svenska SkogsvFören. Tidskr.* 1956 no. 4 pp. 411–421, 1 col. pl., 2 figs., 10 refs.; also as *Medd. SkogsforsknInst.* Ser. Uppsats. no. 48. Stockholm, 1956. (With a Summary in German.)

Oligonychus (*Paratetranychus*) *ununguis* (Jacobi) is an important pest of spruce nursery stock in central Sweden, spinning the shoots together and causing the needles to turn yellow or brown and ultimately to drop. Three-year-old plants are the most heavily attacked. It also occurs on spruce in the open and on several other species of conifers, but damage is light in the extreme south. In view of this, the author undertook a journey to Denmark and north-western Germany in 1954 to investigate conditions there. The mite was common on spruce in the open in both regions, but rare in nurseries, apparently owing to the good growing conditions provided, which were similar to those in southern Sweden. Cultural measures are recommended, to improve the vigour of the plants and so render them less liable to attack, together with regular inspection and the removal of infested plants, and treatment with suitable acaricides if necessary.

JUUTINEN (P.). **Zur Biologie und forstlichen Bedeutung der Fichtenböcke** (*Tetropium* **Kirby) in Finnland.** [On the Bionomics and Importance in Forestry of *Tetropium* spp. on Spruce in Finland.]—*Acta ent. fenn.* no. 11, 112 pp., 15 figs., 5½ pp. refs. Helsinki, 1955. (With a Summary in Finnish.)

Investigations were begun in 1951 on the bionomics of *Tetropium castaneum* (L.) and *T. fuscum* (F.) on spruce in Finland, and the following is based on the author's summary of the results.

These two Cerambycids are widespread in Finland and have only twice been recorded from conifers other than spruce. The females oviposit 3–4 days after emerging from the pupal cells, and the numbers of eggs laid per female in the laboratory were 80–150 for *T. castaneum* and 28–108 for *T. fuscum*. The larvae mine mainly between the bark and the sapwood and pupate in the sapwood, between this and the bark, or in the latter. They digest sugar in considerable quantities during feeding, but not cellulose. The adults were not observed to feed. A generation usually lasts a year in the south of Finland and two years in the north. Adults were present from late May to mid-August, depending on year and locality, pupae from mid-May to the beginning of July, and larvae at all times of the year. Only the larvae are able to survive the winter under normal conditions. In laboratory tests, the larvae developed most rapidly at 34°C. [93·2°F.] or above, but the egg and pupal stages were shortest at 29°C. [84·2°F.]. The threshold of development was a little below 5°C. [41°F.] for the larvae and pupae and between 5 and 7°C. [44·6°F.] for the eggs. Development at constant temperatures was slow, owing to the occurrence of a diapause in the larvae. Exposure to cold was necessary to induce rapid pupation, and larvae not so exposed either failed to pupate or did so only after considerable periods. Increase in numbers was prevented to various degrees by unfavourable weather, which delayed development, insectivorous birds, parasites, of which *Helcon aequator* Nees was the most important and attacked the larvae of both species of *Tetropium*, and the resin flow from the injured trees.

Older trees were preferred for attack, especially those that had begun to dry up from other causes. The injury was therefore secondary, but was nevertheless considerable, contributing to the death of the tree and rendering it liable to infestation by still other insects. Infested trees usually died within a year in the south, and within five years in the north. The damage is usually light in well-managed forests and can be reduced to a minimum by forest hygiene and measures designed to maintain the condition of stands.

OINONEN (E. A.). **Kallioiden muurahaisista ja niiden osuudesta kallioiden metsittymiseen Etelä-Suomessa.** [On the Ants of the Rocks and their Contribution to the Afforestation of Rocks in southern Finland.]—*Acta ent. fenn.* no. 12, 212 pp., 51 figs., 7 maps, 10 tables (9 fldg.), 4½ pp. refs. Helsinki, 1956. (With a Summary in English, pp.179–212.)

This is a detailed account of observations in southern Finland on the extent to which various species of ants that build their nests on rocks gradually contribute to the afforestation of bare areas by accumulating soil and litter in which plants and ultimately trees can grow. The commonest of the species concerned in the origination of the process is *Lasius flavus* (F.), but this is later replaced by others as the advent of vegetation renders conditions unfavourable for it.

NUORTEVA (M.). **Über den Fichtenstamm-Bastkäfer,** *Hylurgops palliatus* **Gyll., und seine Insektenfeinde.** [The Spruce Bark-beetle, *Hylastes palliatus*, and its Insect Enemies.]—*Acta ent. fenn.* no. 13, 118 pp., 5 figs., 7 pp. refs. Helsinki, 1956. (With a Summary in Finnish.)

Investigations were made in southern Finland in 1953–55 on the importance of *Hylastes* (*Hylurgops*) *palliatus* (Gylh.) in maintaining populations of natural enemies that also attack other bark-beetles. *H. palliatus* is common throughout Finland, but is only a secondary pest. It breeds mostly in spruce, but also commonly in pine, and was mostly found in stumps. There is only one generation a year, the adults emerging in early July and overwintering, and oviposition beginning in May. Its natural enemies comprised 25 species of predacious beetles, the predacious larvae of several species of *Medetera*, and three Chalcidoid parasites. Notes on all these are given, and it is shown that together they afford considerable control. They all also attack other bark-beetles, including some that are important pests, and their increase will be promoted by measures that favour *H. palliatus*, the most suitable of their hosts for this purpose.

ZEČEVIĆ (D.). **Zimska ishrana i razviće gubara pod laboratoriskim uslovima 1952–1953.** [Winter Feeding and Development of *Lymantria dispar* under Laboratory Conditions in 1952–53.]—*Plant Prot.* no. 28 pp. 3–20, 1 pl., 7 graphs, 12 refs. Belgrade, 1955. (With a Summary in English.)

The following is based on the author's summary. Two batches of eggs of *Lymantria dispar* (L.) collected in Slovenia were brought to the laboratory in November 1952. Hatching began immediately and was completed in 178 days in one batch and 77 in the other. Leaves of *Pyracantha coccinea* were provided as food for the larvae, and among the latter, males and females became full-fed in 67–74 and 70–80 days, respectively, for the first batch and in 74–77 and 77–103 days for the second. The pupal stage lasted about 21 days, and adults emerged between late February and early April; males were considerably more numerous than females. Pairing and oviposition occurred at once, the oviposition periods of individual females ranging from 5 to 12 days. The numbers of eggs per cluster were 187–680. Eggs kept in the laboratory or under outdoor conditions hatched on 2nd June and those exposed in mid-May to a temperature ranging from 0 to −5° [32–23°F.], which is usually considered necessary for normal development, on 22nd June. These results suggest that *L. dispar* might produce a second generation in the year under suitable field conditions.

Maksimović (M.), Hadžistević (D.) & Radonjić (S.). **Ogledi suzbijanja grčica u šumskom rasadniku na Zlatiboru.** [Experiments on the Control of Melolonthid Larvae in a Forest Nursery in the Zlatibor Mountains.]—*Plant Prot.* no. 28 pp. 45–54, 1 pl., 2 refs. Belgrade, 1955. (With a Summary in English.)

The following is based partly on the authors' summary. Melolonthid larvae are injurious to seedlings of black pine (*Pinus nigra*) in a nursery in the Zlatibor mountains, in Serbia, and experiments on their control were carried out in 1953. Heavy flights of *Amphimallon* (*Amphimallus*) *solstitiale* (L.) and *A.* (*A.*) *assimile* (Hbst.) occurred in that year, but *Melolontha melolontha* (L.) was not numerous. Soil treatment with calcium carbide proved useless against the larvae, even at 72 lb. per acre, but good control was given by pouring a γ-BHC suspension into channels between the rows of seedlings at rates equivalent to 0·75–1·5 oz. γ BHC per sq. yard. Various BHC dusts also proved satisfactory.

Lazarević (B.). **Dejstvo nekih organskih insekticida na gusenice gubara.** [The Effect of some organic Insecticides on the Larvae of *Lymantria dispar*.]—*Plant Prot.* no. 28 pp. 55–62, 2 graphs, 2 refs. Belgrade, 1955. (With a Summary in English.)

Laboratory and field tests in Yugoslavia on the comparative effectiveness of various proprietary spray preparations of DDT and BHC against the larvae of *Lymantria dispar* (L.) showed some to be distinctly preferable to others, though all gave some control. Second- and third-instar larvae were equally susceptible.

Maceljski (M.). **Iskustva pri radu sa ručnim zamagljivačima "Swingfog".** [Experiments with the Swingfog portable Fog-machine.]—*Plant Prot.* no. 28 pp. 81–92, 2 pls. Belgrade, 1955. (With a Summary in French.)

The Swingfog machine [*cf. R.A.E.*, A **42** 393] was tested in Yugoslavia in 1954 for the application of DDT aerosols against several plant-feeding insects. It proved very effective against *Hyphantria cunea* (Dru.) on trees and low-growing plants, but its use was greatly dependent on the wind, too little preventing the spread of the aerosol and too much carrying it away.

Džutevski (B.). **Akcija suzbijanja gubara u NR Makedoniji u 1953/54 godini.** [The Campaign against *Lymantria dispar* in Macedonia in 1953–54.]—*Plant Prot.* no. 28 pp. 99–105, 1 pl., 1 map. Belgrade, 1955. (With a Summary in English.)

An outbreak of *Lymantria dispar* (L.) occurred in August 1953 in a forest district in Macedonia and spread to further areas in the district in 1954. The trees chiefly infested were dense stands of oaks (*Quercus coccifera*), and the method of control adopted was therefore the application of a DDT fog from aeroplanes. This was applied in mid-May 1953 and gave excellent control of the larvae, but destroyed beneficial insects, including silkworms [*Bombyx mori* (L.)] that were being reared on the leaves of mulberry trees growing in the vicinity.

[SISOYEVIT' (P.).] SISOJEVIĆ (P.). **Prilog poznavanju tahina gubara u Jugoslaviji.** [Contribution to Knowledge of the Tachinids parasitising *Lymantria dispar* in Yugoslavia.]—*Plant Prot.* no. 28 suppl. pp. 3–10, 9 refs. Belgrade, 1955. (With a Summary in German.)

The results are given of a survey of the parasites attacking *Lymantria dispar* (L.) in a mixed stand of poplar and willow on an island in the Danube, near Belgrade, and a stand of oaks at Mladenovac, to the south of that city. On the island, Tachinids were rather less numerous than Sarcophagids; *Tachina (Exorista) larvarum* (L.) was much the commonest, and *Phorocera agilis* R.-D. and *Sturmia (Blepharipoda) scutellata* (R.-D.) comprised almost all the others. Six species of Tachinids and six of Sarcophagids were present. At the other place, Tachinids were far more numerous than Sarcophagids, and almost all of them were *Compsilura concinnata* (Mg.), *T. larvarum* being the next commonest.

GEORGHIOU (G. P.). **Contribution to the Control of the Mediterranean Fruit Fly** (*Ceratitis capitata*, **Wied.**) **on Oranges with Dieldrin and poisoned Bait Sprays.**—*Tech. Bull. Dep. Agric. Cyprus* (N.S.) no. 1/56, 18 pp., 1 fldg. map, 17 tables, 20 refs., multigraph. [Nicosia] 1956.

The following is based on the author's summary. Experiments on the control of *Ceratitis capitata* (Wied.) were carried out in eight groves of shamuti oranges in Cyprus in 1955. The treatments tested were a cover-spray of 0·1 per cent. dieldrin at about 600 gals. per acre, and a bait-spray containing 0·5 per cent. malathion and 5 per cent. sugar, applied to a patch of foliage on the south side of each tree at 5 gals. per acre. The strength of the bait-spray was doubled after mid-November. The dieldrin spray was applied once or twice, whereas the bait-spray was repeated as soon as the effect of the previous application had disappeared. Conclusions were based on the level of the fruit-fly population before and after treatment, as indicated by bait-traps, and on the percentage of fruits infested at harvest.

The first dieldrin spray, applied in late September or early October, invariably gave a sharp reduction in adult population, and this reduction persisted for 32–40 days in heavily infested areas and until harvest (60 days) in areas in which the population was smaller. The effect of the second dieldrin spray, applied in early November, was poor, owing to heavy rain soon after application. The bait-sprays reduced the adult population to a level several times below that in the control plots, but the duration of effectiveness was influenced by rain and atmospheric humidity.

Fruits harvested from dieldrin-treated trees in mid-November showed 0·38 per cent. infestation, as compared with 4·66 per cent. for no treatment, and those harvested in February showed 1·33–2·08 per cent., as compared with 16·91–18·05 per cent. A plot treated four times at irregular intervals with the bait-spray had an infestation of 8·94 per cent. In a less heavily infested grove, trees treated three times with the bait-spray showed 2·15 per cent. infestation, as compared with 4·04 per cent. for the controls.

In a laboratory test, complete mortality of adults of *C. capitata* was given within 24 hours by exposure to leaves bearing deposits from the dieldrin spray applied 42 days previously.

Limited field tests indicated that the inclusion of a partly hydrolysed protein material increased the attractiveness of the malathion-sugar bait to *C. capitata* almost five times.

Ertürk (H.). **Anbarlanmış mahsüller üzerinde önemli bir zararlı** *Trogoderma granarium* **Everts.** [*T. granarium*, an important Pest of Stored Products.]—*Tomurcuk* **5** no. 50 pp. 16, 17, 4 refs. Istanbul, 1956.

A species of *Trogoderma* observed infesting stored grain in Turkey since 1940 was recently identified as *T. granarium* Everts, the world distribution of which is briefly reviewed. It is present in the south-east, near Diyarbakir, where it is favoured by the hot dry climate, and causes serious damage to stored wheat and barley.

Yürüten (O.). *Tanymecus dilaticollis* **(Gyllenhal).** [*In English.*]—*Tomurcuk* **6** no. 64 pp. 4–6, 4 figs. Istanbul, 1957.

Tanymecus dilaticollis Gylh. has since 1948 been very injurious to cereal crops in northern Turkey, where the adult weevils appear in early spring and attack sprouting grain and particularly maize seedlings, destroying the latter completely and then migrating to other fields. Oviposition occurs after a short period of intense feeding and reaches its peak in May. The eggs are deposited in the soil, singly or in groups, the females laying about 50–60 each, and hatch in 10–15 days. Development is completed in the soil, in which the newly emerged adults overwinter.

Bodenheimer (F. S.) & Swirski (E.). **The Aphidoidea of the Middle East.**—9½ × 6½ ins., [5+] 378 pp., 55 figs., 17 pp. refs. Jerusalem, Weizmann Sci. Pr. Israel, 1957. Price £3.

This comprehensive monograph is concerned primarily with the Aphids of Israel, but the whole area covered ranges from Egypt in the south to Turkey in the north and Persia in the east. It consists of an introductory section, in which the difficulties of the subject are stressed, over 200 species of Aphids known from the region are listed, and terms used in describing Aphid life-cycles are defined, a considerable section on the ecology of the Aphids of the Middle East, keys to the genera and species, a systematic list of the species showing the countries from which they were originally described, their synonyms, the principal references to them, their food-plants and distribution in the Middle East and elsewhere, and their life-histories, and a list of the food-plants, showing the Aphids that infest them, together with a bibliography and an index to the Aphid species.

The section on ecology (pp. 15–169) comprises discussions of the life-cycles of Aphids in general and of those that occur in the Middle East, the life-histories, including food-plants, of the latter, the dispersal, orientation, locomotion and phylogenesis of Aphids, the distribution and biometrics of the Israeli species, the ecology and physiology of Aphid nutrition, Aphid galls, the honeydew and manna produced by Aphids, the relations of ants to Aphids, the effects of climate and natural enemies on Aphid populations, with special reference to conditions in Israel, and Aphids as pests of crops and ornamental plants in the various countries of the Middle East and their control.

SALVATIAN (M.). *Earias insulana* **Boisd.** [*In Persian.*]—*Ent. Phytop. appl.* no. 16–17 pp. *17–76*, 7 figs., 2 graphs, 1 fldg. table. Teheran, 1957. (With a Summary in French, pp. 8–11, 8 refs.)

Earias insulana (Boisd.) and *Tetranychus telarius* (L.) (*urticae* Koch) are serious pests of cotton in Khuzistan, south-western Persia, where the former produces five generations during the cotton season and infests some 56 per cent. of the buds and 64 per cent. of the bolls in autumn [*cf. R.A.E.*, A **39** 205], but are less injurious at Garmsar, near Teheran, where *E. insulana* produces four generations during the season and passes the late autumn and winter in the pupal stage. Tests on the control of the two pests were carried out in both areas in 1954–55. Sprays of barium fluosilicate were ineffective against *Earias*, and of the various organic materials tested, endrin at 0·45 lb. and Systox [diethyl 2-(ethylthio)ethyl phosphorothioate] at 0·225–0·27 lb. in 18–31·5 gals. water per acre in spring and 56–72 gals. in autumn gave the best control of *Earias* and the mite, respectively, retained their effectiveness for two and four weeks, and more than tripled the yield in Khuzistan. Schedules of sprays for application in the two areas are suggested.

BANERJEE (S. N.) & BASU (A. N.). **Experiments on the Control of the Brinjal Mealy Bug,** *Centrococcus insolitus* **(Green), in West Bengal.**—*Proc. zool. Soc. Calcutta* **9** no. 1 pp. 45–52, 1 pl., 1 graph, 5 refs. Calcutta, 1956.

Centrococcus (*Phenacoccus*) *insolitus* (Green) has lately become an important pest of brinjal (*Solanum melongena*) in West Bengal, India, especially during the rainy season. It prefers older plants, feeds on the lower surface of the leaves, which it causes to wilt, and excretes honeydew, on which sooty moulds develop. Infested plants ultimately die. The mealybug appears on the plants at the end of May, multiplies rapidly, and persists until mid-October. Various sprays were tested for its control, and and the mortality percentages for nymphs and adults were calculated according to Abbott's formula [*R.A.E.*, A **13** 331]. In field tests, DDT, dieldrin and endrin proved ineffective, and an emulsion of kerosene and soap gave some control but scorched the leaves. The best result was given by Basudin (an emulsion concentrate containing 20 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate]) at a concentration of 0·1 per cent., which gave 68·9 per cent. kill in 48 hours. In a laboratory test, the percentage kills were 74·7 and 89·5 for 0·1 and 0·2 per cent. Basudin and 54·5 and 79 for 0·1 and 0·2 per cent. nicotine sulphate. All materials were ineffective against the eggs, so that if these are present at the time of treatment, a second application should be made as soon as they hatch.

PUTTARUDRIAH (M.) & CHANNA BASAVANNA (G. P.). **A Note on the larval Parasites of the Lablab Pod-borer** (*Adisura atkinsoni* **Moore**).—*Mysore agric. J.* **31** no. 1 pp. 28–31, 6 refs. Bangalore, 1956.

Adisura atkinsoni Moore is a serious pest of *Dolichos lablab* in southern India, the larvae infesting the buds, flowers and pods [*cf. R.A.E.*, A **24** 599]. The only parasite of the larvae so far recorded is apparently *Bracon lefroyi* (D. & G.) [*cf.* **9** 72], though it has occasionally been misidentified [*cf.* **6** 46]. When pods infested by *A. atkinsoni* were kept for emergence of parasites, two Ichneumonids, *Hymenobosmina* sp. and *Enicospilus* sp., emerged from them, in addition to *B. lefroyi*. Investigations on the incidence of the three parasites were made by collecting infested pods near Bangalore in November–January in 1953–54 and 1954–55. The parasitism percentages were very low in November and December, but were 32·5, 1·8 and 1·5 in January 1954 and 38, 14 and 3 in January 1955 for *Bracon*, *Hymenobosmina* and *Enicospilus*, respectively. *Hymenobosmina* and *Enicospilus* are endoparasites, but they leave the host larvae before pupating. Only one individual develops per host. *B. lefroyi* is an ectoparasite, 4–12 adults emerging per host larva 10–15 days after oviposition. As it increases in numbers only towards the end of the season, control might be improved by liberating it earlier, and attempts are being made to find an alternative laboratory host that can be reared throughout the year and a suitable technique for the mass-production of the parasite.

RAU (S. Ananda). **Flushworm.**—*Bull. unit. Plant. Ass. S. India*, Sci. Dep. (Tea Sect.) no. 15 pp. 14–18. [Coonoor] 1956.

Cydia leucostoma (Meyr.), which had not hitherto been of great importance, became unusually numerous on tea in central Travancore in 1955. Preliminary investigations on control were made in January 1956 with organic insecticides, and the results are given in tables. Malathion 50 per cent. emulsion concentrate, malathion 25 per cent. wettable powder, and DDT 50 per cent. wettable powder at concentrations of 4 oz., 8 oz. and 4 lb. in 40 gals. water per acre, respectively, applied twice, with an interval of eight days, reduced the numbers of infested shoots per lb. of green leaf by 55·4, 46·8 and 54·7 per cent., respectively, in three weeks, whereas endrin 19·5 per cent. emulsion concentrate at 2·5 lb. in 40 gals. per acre gave only 14·6 per cent. reduction. As infestation subsequently increased a third application is recommended.

KUNG (K. S.). **The Banana Stem-borer Weevil** *Odoiporus longicollis* **Oliv. in Taiwan.** [*In Chinese.*]—*J. Agric. For. Taiwan* **4** pp. 80–113, 4 pls., 9 refs. Taichung, 1955. (With a Summary in English.)

Investigations on the life-history and control of *Odoiporus longicollis* (Ol.) [*cf. R.A.E.*, A **21** 391] were carried out in 1954–55 in Formosa, where this weevil is one of the most important pests of banana. All stages are described, and tables are given showing the differences in morphology and bionomics between it and *Cosmopolites sordidus* (Germ.), which also infests banana in Formosa.

O. longicollis was observed to have four or more generations a year, and all stages continued development during the winter. The eggs were usually laid singly in the stems under the leaf-sheaths, particularly on weak plants or injured growth, or at the ends of cut stems. The females laid up to 17 eggs each, with an average of about six. The larvae bored in the stems, particularly in the upper parts, and also damaged the fruit-stalks. They pupated near the surface of the stem in cocoons formed from the fibres of the plant. In February–April, the egg, larval, prepupal and pupal stages lasted 5–12 days, 3–6 weeks, 3–9 days and 3–13 days, respectively, and the newly emerged adults remained in their cocoons for 7–14 days. In September and October, the egg and larval stages lasted 3–5 and 25–27 days, respectively, and the ratio of males to females among adults collected in the field was about 2:3. The amount of damage caused was in inverse proportion to the vigour of the plant, and the summer was unfavourable for development.

In field-tests against the ovipositing females, a wettable powder containing 50 per cent. dieldrin and an emulsion concentrate containing 19·5 per cent.

endrin gave nearly 90 and 88 per cent. kill, respectively, at a concentration of 0·25 per cent., and 84 and about 80 per cent. at a concentration of 0·17 per cent., and oviposition was prevented. Other insecticides tested were less effective. Other means of control are hand-picking of the adults and the use of traps consisting of pieces of cut stem.

DUN (G. S.). **Economic Entomology in Papua and New Guinea 1948–1954.**—*Papua New Guinea agric. J.* **9** no. 3 pp. 109–119, 4 figs. Port Moresby, 1955.

This is essentially a review of research on invertebrate pests of plants and their control in New Guinea in 1948–54. The main export crops affected are coconuts and cacao. The principal pests of coconut are *Oryctes rhinoceros* (L.), which is established on the Gazelle Peninsula of New Britain and in parts of New Ireland, Tettigoniids, chiefly *Sexava nubila* (Stål) and *S. novaguineae* (Brancsik), which occur in several localities in the Bismarck Archipelago, and *Promecotheca papuana* Csiki, which causes serious injury only at scattered points at the western end of New Britain. *Scolia ruficornis* F., from Zanzibar, and *S. oryctophaga* Coq., from Mauritius, were liberated against *Oryctes* in 1952–53, and the predacious Histerid, *Pachylister* (*Platylister*) *chinensis* (Quens.), from Fiji, was released in infested areas where cattle are grazed. Other natural enemies of the Dynastid were also investigated. Preliminary tests indicated that treatment of compost pits with 6·5 per cent. γ BHC dust at 2 oz. per 10 cu. ft. gave up to 90 per cent. reduction in the larval population for six months. No effective insecticide treatment against *Sexava* is known, but several outbreaks in New Britain and New Ireland were controlled by mass liberation of *Leefmansia bicolor* Wtstn., which was originally introduced in 1933 and is reared to provide stocks for release.

The pests of cacao on which most work was carried out are species of the genus *Pantorhytes*, including *P. plutus* (Oberth.) [*cf. R.A.E.*, A **45** 215, etc.], and *Glenea aluensis* Gah., which bore in the stems, and Mirids [**43** 232, etc.]. Notes on minor pests are included.

SZENT-IVANY (J. J. H.). **The Cupmoth** *Scopelodes dinawa* **B. Bak. (Family Limacodidae) as a Pest of Manila Hemp and Mango.**—*Papua New Guinea agric. J.* **9** no. 3 pp. 124–128, 7 figs., 5 refs. Port Moresby, 1955.

The author records the finding of larvae of *Scopelodes dinawa* B.-B. defoliating mango and manila hemp (*Musa textilis*) in the Morobe district of New Guinea, briefly describes all stages but the egg, and gives very brief notes on the habits of this and other Limacodids. On mango, a spray of 1 per cent. white oil gave satisfactory control.

GRYLLS (N. E.). **An Outbreak of Rugose Leaf Curl Disease on Clover in Queensland.**—*J. Aust. Inst. agric. Sci.* **21** no. 3 pp. 187–188, 1 ref. Sydney, 1955.

Plants of red and white clover [*Trifolium pratense* and *T. repens*] infected with the virus of rugose leaf curl [*R.A.E.*, A **43** 359] were observed in south-eastern Queensland in 1954, and the first major outbreak of this disease to be recorded occurred in two mixed pastures in the same district in April 1955. In one of them, 10–12 per cent. of the red clover and some white-clover plants were infected, and in the other, which was composed of red clover and *Phalaris*, attack was more severe and many plants about one year old were dead. Of 140 plants in a traverse across a grazed plot, 70 were definitely, and a further 22 doubtfully, infected. A few plants in adjoining white-clover plots were also attacked. Small numbers of the vector, *Austroagallia torrida* Evans [*cf. loc. cit.*], were present on both the red and the white clover.

WARK (D. C.). **A heritable Variation in Tobacco of Palatability to Looper Caterpillars.**—*J. Aust. Inst. agric. Sci.* **21** no. 3 pp. 189–192, 2 figs. Sydney, 1955.

During 1952–54, some varieties of tobacco in northern Queensland were observed to be unpalatable to larvae of *Plusia argentifera* Gn., and the attractiveness of leaves from plants of these varieties, others known to be susceptible, and hybrids between them were tested in the laboratory. Leaves from the different plants were suspended for 60 hours in a box containing larvae, in such a manner that the latter could reach them from the sides and bottom. The outline of each leaf was traced on paper before and after exposure, and the proportion eaten was estimated as the difference in weight between the two paper shapes. The results indicated considerable differences in palatability between the varieties. Unpalatability was recessive in the F_1 generation of all the crosses tested, and evidence was obtained from the F_2 generation that many genes are involved in determining relative palatability.

STUBBS (L. L.). **Retention of Carrot Motley Dwarf Virus in *Cavariella aegopodii* (Scop.) following a Moult.**—*J. Aust. Inst. agric. Sci.* **21** no. 4 pp. 267–268, 2 refs. Sydney, 1955.

Since investigations in Australia on the transmission of the carrot motley dwarf virus by *Cavariella aegopodii* (Scop.) showed a clearly defined latent period in some tests but not in others [*R.A.E.*, A **37** 275], the virus was subsequently listed as non-persistent [**44** 265]. In an experiment to determine the accuracy of this classification, examples of the Aphid approaching the adult stage were taken from a clone bred on infected carrot, caged singly on healthy slender celery (*Apium leptophyllum*), which is a poor source for the virus, and transferred during the next three days, after moulting to alate adults, to further test plants. About half the Aphids transmitted the virus before and after moulting, and of the others, some did so before, some after, and some not at all. It is concluded that the mechanism of transmission is ingestion followed by re-injection during feeding [*cf.* **44** 267].

BARR (H. E.), CLARK (P. J.) & JACKS (H.). **Parathion Spray Residue on Apples, Beans, and Quinces.**—*N.Z. J. Sci. Tech.* **37** (B) no. 5 pp. 623–625, 4 refs. Wellington, N.Z., 1956.

In investigations in New Zealand in 1949–55, the parathion residues on apples of six varieties that received up to nine applications of sprays of 15 per cent. wettable parathion at 0·5–2 lb. per 100 gals. or a 20 per cent. parathion emulsion concentrate at 1 pint per 100 gals., of which the last was made at least 30 days before harvest, varied from 0·1 to 0·18 part per million. In a test in 1954–55, the residues on quinces that received seven or eight applications of the emulsion spray and were harvested ten days after the last one were found to be 0·15 and 0·38 p.p.m., respectively.

In 1949–50, the mean residue on beans that were sprayed with wettable parathion or the emulsion concentrate at concentrations of 0·5–1 lb. per 100 gals. and harvested 16 days after the last application was significantly higher (0·1 p.p.m.) than on those harvested a week after spraying (0·03 p.p.m.).

GIANG (P. A.), SMITH (F. F.) & HALL (S. A.). **Enzymatic Estimation of Dimethyl 2,2-Dichlorovinyl Phosphate Spray Residues.**—*J. agric. Fd Chem.* **4** no. 7 pp. 621–622, 5 refs. Easton, Pa., 1956.

The following is based on the authors' summary. Preliminary tests in Hawaii indicated that DDVP (dimethyl 2,2-dichlorovinyl phosphate) is very effective against the oriental fruit-fly [*Dacus dorsalis* Hend.] and the melon fly [*D. cucurbitae* Coq.]. The enzymatic method, developed for determining organic phosphorus insecticides [*R.A.E.*, A **40** 203], was therefore modified for the determination of DDVP on subtropical fruits and also applied to certain greenhouse plants. The modified method consists in extraction of DDVP from plant residues with chloroform, evaporation of the extract in the presence of 20 per cent. aqueous ethanol solution, adjustment to pH 7, and measurement of the DDVP by its inhibition of cholinesterase. The method, which is sensitive to 0·5 μg. DDVP, showed that DDVP residues virtually disappear in 72 hours.

HORNSTEIN (I.). **Use of Granulated Zinc Columns for determining Chlorinated Organic Insecticides.**—*J. agric. Fd Chem.* **5** no. 1 pp. 37–39, 7 refs. Easton, Pa., 1957.

The following is the author's summary. As a measure of the insecticide present, the chlorine content of chlorinated organic insecticides is often determined. A simple procedure has been developed for the partial or complete removal of the organically bound chlorine as chloride ion by the percolation of an acidified solution of the insecticide through a granulated zinc column. The fraction of the chlorine removed as chloride ion is a function of the molecular structure of the compound and is a reproducible value for a given insecticide. The chloride ion liberated is determined by potentiometric titration with silver nitrate. Applied to formulations and technical products, the procedure has a degree of specificity not available in analyses dependent on total chlorine determinations.

HORNSTEIN (I.). **Colorimetric Determination of Toxaphene.**—*J. agric. Fd Chem.* **5** no. 6 pp. 446–448, 2 graphs, 3 refs. Easton, Pa., 1957.

The following is virtually the author's summary. A method has been developed for determining as little as 0·5 mg. toxaphene or 0·25 mg. Strobane [a chlorinated mixture of α-pinene isomers] in 5 ml. solution, and has been applied to toxaphene added to extracts of lucerne and butterfat. In tests with other chlorinated insecticides, interferences were encountered only with chlordane and heptachlor.

JACOBSON (M.). **Constituents of *Heliopsis* Species. V. Heliopsin, a second Insecticidal Amide from the Roots of *H. helianthoides* var. *scabra*.**—*J. Amer. chem. Soc.* **79** pp. 356–358, 5 refs. Easton, Pa., 1957.

The following is virtually the author's summary. Heliopsin, an unsaturated isobutylamide closely related to scabrin [*cf. R.A.E.*, A **40** 7], has been isolated from the roots of *Heliopsis helianthoides* var. *scabra* (formerly *H. scabra*). It is a powerful sialagogue, and is as toxic as pyrethrins to house-flies [*Musca domestica* L.]. Hydrogenation, hydrolysis, oxidation, and ultraviolet and infrared absorption spectra of heliopsin show it to be the N-isobutylamide of either 2,4,8,10,12,16- or 2,4,8,12,14,16-octadecahexaenoic acid. The geometrical configuration of heliopsin has been partially determined.

JACOBSON (M.). **The Structure of Spilanthol.**—*Chem. & Ind.* 1957 pp. 50–51, 8 refs. London, 1957.

The structure of spilanthol, the insecticidal constituent of the flower heads of *Spilanthes* spp. [*cf. R.A.E.*, A **42** 228], is shown to be N-isobutyldeca-2,6,8-trienamide, and so is identical with that of affinin [**36** 25]. Infrared spectra of spilanthol and of a sample of affinin obtained from roots of *Heliopsis longipes* were superimposable, and both materials gave the same high knockdown and kill in tests against house-flies [*Musca domestica* L.] and mosquito larvae.

LEFKOVITCH (L. P.). **The Biology of *Cryptolestes ugandae* Steel & Howe (Coleoptera, Cucujidae), a Pest of Stored Products in Africa.**—*Proc. zool. Soc. Lond.* **128** pt. 3 pp. 419–429, 6 graphs, 10 refs. London, 1957.

In view of the possibility that *Cryptolestes ugandae* Steel & Howe, which attacks stored products in Uganda, Ghana and Nigeria [*cf. R.A.E.*, A **44** 340], may become more widespread with the increase in exports from Africa, its bionomics were investigated in the laboratory. The experiments were carried out at constant temperatures and humidities, and wheatfeed was provided as food. The eggs hatched at temperatures of 17·5–37·5°C. [63·5–99·5°F.], though mortality was high (72 per cent.) at 37·5°C., and the duration of the egg stage ranged from about ten days at 17·5 to one day at 37·5°C.; they were little affected by relative humidity, and hatched even when it was only 10 per cent. The newly hatched larvae survived for at least 24 hours without food and there were four larval instars. Some larvae constructed cocoons before pupating, over half doing so at 25–32·5°C. [77–90·5°F.] and 90 per cent. relative humidity and none at 17·5°C., 27·5–30°C. [81·5–86°F.] and 35°C. [95°F.] and 90, 50 and 70 per cent. relative humidity, respectively. After hatching, development to the adult stage was possible at 17·5–35°C. and was most rapid at about 30°C. At 90 per cent. relative humidity, it required means of 18·3 days at 30°C., 125 days at 17·5°C. and 26·6 days at 35°C.; mortality was lowest between 20 and 27·5°C. and rose to 29·5 per cent. at 30°C. At 70 and 50 per cent. relative humidity, development required 22·7 and 53·6 days at 30°C., and mortality amounted to 42·4 and 76·7 per cent. Crowded conditions delayed development, and the larvae attacked one another at densities exceeding about six per 100 mg. wheatfeed. The durations of the prepupal and pupal stages were least (1·5 and 4 days) at 32·5°C. and were comparatively little affected by temperature or humidity. The two sexes were about equal in numbers. Males were usually heavier than females on emergence, and their weight was more affected by temperature; both sexes were heaviest at intermediate temperatures and high humidities. The females oviposited at temperatures of 17·5–27·5°C. and relative humidities of 50–90 per cent., but most eggs were laid at 30°C. and 90 per cent. relative humidity. Unfertilised females did not oviposit. Under conditions permitting oviposition, the adults survived for over three months. The intrinsic rates of increase were calculated from the experimental results [*cf.* **41** 311, etc.], and the shortest period in which a population could double itself was found to be 7½ days. Because of its high humidity requirements, *C. ugandae* is thought unlikely to become as widespread as *C. minutus* (Ol.) or *C. ferrugineus* (Steph.).

STEFFAN (J. R.). **Note sur deux parasites d'une pyrale sud-africaine d'importance économique,** *Loxostege frustalis* **Zell.**—*Bull. Mus. Hist. nat.* (2) **28** no. 2 pp. 191–198, 19 figs. Paris, 1956.

Descriptions are given of the adults of *Peltochalcidia capensis* Steffan (typical form) and *Lasiochalcidia spinigera*, sp.n., both reared from pupae of *Loxostege frustalis* (Zell.) in Cape Province, and of three new varieties of *P. capensis*, for which the names *bidentata*, *trifoliata* and *lingulata* are proposed. All three are from Cape Province, and vars. *bidentata* and *trifoliata* from South-West Africa also.

POLLARD (D. G.). **The Insect Pests of Vegetables in the Sudan.**—*Bull. Minist. Agric. Sudan* no. 16, 64 pp., 7 pls. (1 col. fldg.), 1 col. fldg. chart. Khartoum, 1955.

The information in this bulletin is based mainly on records from the northern and central regions of the Sudan, where most of the local research on pests of vegetables has been carried out, and is arranged under the plants concerned. The appearance, bionomics, distribution and control of the pests are described, and there is an introductory chapter on methods of control, with notes on insecticides and their uses, and a table showing the crops, the pests attacking them, characteristic features of the infestation and the appropriate control measures.

POLLARD (D. G.) & SAUNDERS (J. H.). **Relations of some Cotton Pests to Jassid resistant Sakel.**—*Emp. Cott. Gr. Rev.* **33** no. 3 pp. 197–202, 2 refs. London, 1956.

Since the resistance of cotton to infestation by Cicadellids of the genus *Empoasca* has been shown to vary with the hairiness of the leaves [*cf. R.A.E.*, A **37** 218, etc.], investigations were begun in the Sudan on the effect of this factor on infestation of Egyptian cotton (*Gossypium barbadense*) by *E. lybica* (de Berg.) and other pests. A glabrous strain and a strain having hairs of moderate length and density on the lower leaf lamina were compared, and it was found that although hairiness conferred resistance to *E. lybica*, it was associated with larger populations of *Bemisia tabaci* (Gennadius), *Aphis gossypii* Glov. and *Tetranychus* sp., the increase in the first two being significant. There was no decided effect on infestation by *Platyedra gossypiella* (Saund.), *Earias insulana* (Boisd.) or thrips (*Hercothrips fumipennis* Bagn. & Cam. and *H. sudanensis* Bagn. & Cam.), but flea-beetles (*Podagrica pallida* (Jacoby) and *P. puncticollis* Weise) showed a marked preference for a non-hairy leaf surface. The need for producing a resistant variety not more susceptible to other pests is emphasised.

STOREY (H. H.) & RYLAND (A. K.). **Viruses causing Rosette and other Diseases in Groundnuts.**—*Ann. appl. Biol.* **45** no. 2 pp. 318–326, 2 pls., 8 refs. London, 1957.

The following is taken almost entirely from the authors' summary. From groundnut plants found in Tanganyika with a form of rosette disease characterised by discrete areas of green and chlorotic tissues on the leaflets and here designated "mosaic rosette" [*cf.* *R.A.E.*, A **16** 337], a virus was separated that produced only a mild mottle or sometimes a mottle with rare chlorotic flecks. It was separated by leaf grafts, by mechanical inoculation and by means of *Aphis craccivora* Koch, the known vector of the normal rosette virus [*cf.* **44** 47]. Plants inoculated simultaneously with the mottle virus and normal rosette virus usually developed the mosaic-rosette symptoms. When the mottle virus was introduced 14–35 days before the rosette virus, the plants failed to develop the severe chlorosis of rosette; this protection was given whether the rosette virus was inoculated by Aphids or by grafting.

Plants showing two other forms of mild mottle were collected in the field in Tanganyika and Uganda, respectively; viruses from them were readily transmitted by grafting or by mechanical inoculation, but not by *A. craccivora*. The one from Tanganyika failed to give complete protection to plants later inoculated with the rosette virus, though the resultant chlorosis and stunting were less severe than in plants infected only with the rosette virus.

DAVID (W. A. L.) & ALDRIDGE (W. N.). **The insecticidal Material in Leaves of Plants growing in Soil treated with Parathion.**—*Ann. appl. Biol.* **45** no. 2 pp. 332–346, 2 graphs, 24 refs. London, 1957.

The following is largely the authors' summary. After solutions containing parathion of different degrees of purity had been watered on to the soil round the roots of cabbage plants with leaves infested with *Brevicoryne brassicae* (L.), *Myzus persicae* (Sulz.) or larvae of *Pieris brassicae* (L.), these leaves showed a toxic effect on the feeding insects [*cf.* *R.A.E.*, A **37** 300; **39** 15; **41** 100]. In comparable experiments, *Aphis fabae* Scop. on leaves of broad bean (*Vicia faba*) was not affected, even at concentrations that damaged the plants (0·5 per cent.). The effect on the cabbage plants was observed when the parathion was of the highest degree of purity, as shown by chemical tests and its negligible anticholinesterase activity, although it was greater with commercial material. It occurred when all possibility of a fumigant action was excluded. When the roots of wheat plants were treated with solutions of pure parathion, the leaf guttation fluid was toxic to larvae of *Aëdes aegypti* (L.) and contained an active anticholinesterase, and this effect was initially stronger when the plants were treated with commercial parathion. The anticholinesterase was shown to be paraoxon; no parathion could be detected in the fluid. The paraoxon was formed rather slowly from the parathion when the roots and leaves of wheat seedlings were immersed in the solution, but it was not formed in the presence of compost alone. In plants treated with pure parathion, the translocation of the paraoxon formed under the influence of the roots was sufficient to account for the toxic effects produced. With commercial parathion, analogues or isomers present as impurities (which are also toxic to larvae of *A. aegypti*) may also be translocated. Both sources of systemic poisons should be borne in mind when considering the treatment with parathion of greenhouse soil in which food crops are to be grown.

POTTER (C.), LORD (K. A.), KENTEN (J.), SALKELD (E. H.) & HOLBROOK (D. V.). **Embryonic Development and Esterase Activity of Eggs of** *Pieris brassicae* **in Relation to TEPP Poisoning.**—*Ann. appl. Biol.* **45** no. 2 pp. 361–375, 8 figs., 12 refs. London, 1957.

Organophosphorus compounds are generally considered to kill by inhibition of the cholinesterase of the nervous system, but preliminary investigations of the effect of TEPP [tetraethyl pyrophosphate] on insect eggs suggested that death might be caused before the development in the embryo of enzymes hydrolysing acetylcholine [*cf. R.A.E.*, A **39** 427]. Its mode of action was therefore further investigated, and the following is largely based on the authors' summary of the results. The embryological development of eggs of *Pieris brassicae* (L.) was studied in relation to the occurrence of enzymes that hydrolyse phenyl acetate and acetylcholine. Seven stages of development are distinguished. Phenyl acetate was found to be hydrolysed at a high rate in all of them, but hydrolysis of acetylcholine became appreciable only in the later stages. The first significant level of hydrolysis of acetylcholine was correlated with the development of a nervous system in the embryo to a stage where it may be functional. When aqueous solutions of TEPP were applied to eggs soon after they were laid, low concentrations (about 0·1 per cent. or less) allowed a high percentage of eggs to develop to the point of hatching before death occurred. Most of the fully developed embryos became active before they died. As the concentration increased, the amount of development that took place decreased until, at high concentrations (about 3 per cent. or more), there was very little [*cf.* **41** 446].

The significance of these results is discussed. The available evidence does not indicate that the poison penetrates slowly or that it is absorbed by lipids and later released. The explanation that seems to fit the evidence best is that the poison penetrates rapidly and reacts irreversibly with one or more components of the egg, probably by phosphorylation, the extent of subsequent development depending upon the proportion of a biochemical system or the number of systems inactivated. Whilst inhibition of cholinesterase may play a part in the poisoning process, at least under certain conditions, the death of the embryo may result from some other cause.

HANNA (A. D.) & HEATHERINGTON (W.). **Arrest of the Swollen-shoot Virus Disease of Cacao in the Gold Coast by controlling the Mealybug Vectors with the Systemic Insecticide, Dimefox.**—*Ann. appl. Biol.* **45** no. 3 pp. 473–480, 1 graph, 4 refs. London, 1957.

The following is based largely on the authors' summary. A 13-acre plot of cacao in an area devastated by swollen-shoot disease in Ghana was treated between June 1952 and September 1953 with 50 per cent. dimefox [bis(dimethylamino) fluorophosphine oxide] for control of the mealybug vectors of the causal virus, of which the principal species are *Pseudococcus njalensis* Laing, *Planococcus* (*Pseudococcus*) *citri* (Risso) and *Ferrisiana* (*Ferrisia*) *virgata* (Ckll.). The insecticide was applied to the soil round each tree at the rate prescribed by the girth-weight correlation regression curve [*R.A.E.*, A **44** 6], and nine applications were made at intervals of about two months. The plot was examined monthly and the trees showing symptoms recorded; these were cut out in August 1952 and May and October 1953, in each case six weeks after an application, and subsequently at monthly intervals until August 1955. The number of diseased trees found on examination decreased very rapidly a year after the first treatment and remained low for the remaining three years of the experiment. This suggests that the time between infection and symptom development can extend to about a year. The cause of the continued appearance of a few diseased trees could not be determined. As cacao farms differ from one another, it was difficult to find suitable control plots. Three farms near the treated area were selected and inspected every month, when trees with fresh symptoms were felled. The initial percentage of diseased trees in each of these was lower than on the treated plot, and the number of diseased trees observed decreased 12 months after the initial cutting out and then increased abruptly until it again reached a high level. It was evident that chemical treatment combined with cutting out was more effective than cutting out alone in arresting the spread of the disease.

Kozarzhevskaya (É. F.). **Biology of** *Leucaspis japonica* **in Abkhazia (Homoptera, Coccoidea).** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 2 pp. 302–310, 5 figs., 6 refs. Moscow, 1956.

Leucodiaspis (*Leucaspis*) *japonica* (Ckll.), of which all stages are described, has become a major pest of *Citrus*, notably mandarin orange, and other fruits in Abkhazia, where it was observed for the first time in 1951. It was presumably introduced with plants from the Soviet Far East. Its distribution in other countries is briefly reviewed, and an account is given of observations on its bionomics and economic importance.

There were two generations a year, the various stages overlapping owing to variations in development. Nymphs in the second instar hibernated beneath leaves and bark scales, and adults were present from mid-April to the end of June. Mass oviposition occurred from the end of May, the numbers of eggs per female averaging 30. Hatching began in late May and reached its peak about 5th July, and oviposition by the second generation began in early July and continued until the beginning of October. Hatching of the crawlers of the second generation began in August and reached a peak at the end of the month. Males were present for about 75 days in both generations.

The Coccid formed dense colonies on the trunks, branches, new growth and, if infestation was heavy, the leaves of its food-plants, and crawlers of the second generation attacked the fruits. Infestation resulted in dropping of the leaves, bark necrosis, and sometimes the drying up of branches or whole trees. Infested pear fruits were distorted, and remained below normal size. Infestation spread slowly, active dispersion being confined to adjacent trees, and wind and the transport of infested fruits were shown to be mainly responsible for spread. Parasites and predators afforded little control, and it is concluded that special measures should be developed to that end.

Bogdanova (N. L.). *Hyperaspis campestris* **(Coleoptera, Coccinellidae)—a Predator of** *Chloropulvinaria floccifera* **(Homoptera, Coccoidea).** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 2 pp. 311–323, 7 figs., 5 refs. Moscow, 1956.

Pulvinaria (*Chloropulvinaria*) *floccifera* (Westw.), the distribution and food-plants of which are briefly reviewed, occurs on the eastern coast of the Black Sea and parts of Transcaucasia, where it has, since 1939, caused severe damage to tea plantations and several ornamental plants. Its principal wild food-plants are holly (*Ilex colchica*) and yew (*Taxus baccata*). Observations on its bionomics near Sochi showed that it had one generation a year, winter being passed in the first or second nymphal instar. Development was resumed in March–April, and the third-instar Coccids caused severe injury to tea bushes at the beginning of summer, when leaves and branches or sometimes whole plants dried up. The adult females appeared in early May, but no males were found. Oviposition continued until mid-June, the number of eggs laid per female averaging 121, 134 and 600 on *T. baccata*, *I. colchica* and tea, respectively. The eggs hatched in 13–15 days, and the crawlers moved to the young growth. From July to September, many of the first-instar nymphs died from unknown causes, and it could not be ascertained whether they fed at all. The first moult occurred in October, and was followed by intensive feeding prior to hibernation.

P. floccifera was attacked by several Coccinellids, but much the most important of these was *Hyperaspis campestris* (Hbst.) [*cf. R.A.E.*, A **44** 140], all stages of which are described. It was a more or less specialised predator of *P. floccifera* and was observed for the first time in 1944 in a tea plantation at Sochi. It had one generation a year, the sexually immature adults overwintering beneath litter at the edges of neighbouring woods from October to April. They appeared in the tea plantation before *P. floccifera* had oviposited, and fed on the nymphs. No reproduction took place in the laboratory, but the average and maximum numbers of eggs found per dissected female were 44 and 77, respectively. Oviposition began at the end of April or beginning of May, mass oviposition coinciding with that of the host. The eggs were laid in the ovisacs of the latter and hatched in 3–4 days at about 20°C. [68°F.]. The larvae remained in the ovisacs for 3–4 days, consuming all the eggs in them, and then attacked those of other individuals. Most of them destroyed an average of 20 ovisacs during the larval stage, which lasted 16–18 days. Pupation took place in June–July, in fallen leaves or on the ground beneath the plants, and the pupal stage lasted 14–15 days. Adults of the new generation emerged in July and fed on secretions of the host. In the laboratory, they fed on sugar syrup and the juice of ripe pears or apples, and they were resistant to prolonged starvation, but died in 10–15 days without water. Migration to their hibernation quarters began in September. Owing to their restricted capacity for flight, active dispersion was slow.

P. floccifera was present in the plantation at the rate of 100 or more per leaf in 1944, when the Coccinellid first appeared, but the latter destroyed 72–93 per cent. of the ovisacs in the next three years, reducing the population to less than ten per leaf in 1948. In 1949, rejuvenation of the plantation resulted in the practical extinction of the Coccid, and consequently of the predator, but the former increased rapidly in 1950 and the latter in 1951, when it destroyed 83·7 per cent. of the ovisacs and re-established control. The Coccinellid was subsequently liberated in three other infested plantations and effected control in all of them, the period required varying with the number released; it is concluded that the liberation of about 400 per acre will reduce the pest to below the level of economic importance in 2–3 years. Release as adults is best; they can be collected and liberated at the end of summer, for control in the following year, or, less easily, in spring, before they emerge from hibernation.

Kamenkova (K. V.). **Flies (Diptera, Phasiidae)—Parasites of Bugs of the Family Pentatomidae in the Province of Krasnodar.** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 2 pp. 324–333, 4 figs., 11 refs. Moscow, 1956.

Several Phasiine Tachinids have been recorded as parasites of the adults of *Eurygaster integriceps* Put. [*cf. R.A.E.*, A **36** 241; **40** 309] and other Pentatomids in the Soviet Union, and their importance in the Abin district of the Province of Krasnodar was investigated in 1950–52 by rearing parasites from bugs collected chiefly on wheat or in the forest, before they migrated to the fields. Information on the habits and distribution of the seven Phasiines found are reviewed from the literature. Those that parasitised *E. integriceps* comprised *Clytiomyia helluo* (F.), *Alophora subcoleoptrata* (L.), *Phasia crassipennis* (F.) and *Helomyia lateralis* (Mg.), but they were of little economic importance since parasitism reached a considerable level only after the end of mass oviposition by the bugs. Control of *E. integriceps* in the Abin district is more likely to be due to Hymenopterous egg parasites, which destroy 90–95 per cent. of the eggs.

GRISYUK (N. M.). **The Noxious Little Tortoise** (*Eurygaster integriceps* **Put.)—a Pest of Forest Trees.** [*In Russian.*]—*Zool. Zh.* **35** pt. 3 pp. 468–470, 3 figs., 6 refs. Moscow, 1956.

Eurygaster integriceps Put., which usually attacks cereals, was found together with other Pentatomids in the summer of 1953, injuring the needles and young shoots of *Pinus nigra*, *P. sylvestris*, *Juniperus communis*, *J. virginiana* and *Thuja occidentalis* in a park in the Province of Kirovograd, causing infested twigs to dry up. This unusual attack is attributed to exceptionally dry weather, which accelerated the ripening of cereal crops and prevented the adults from completing feeding on them in preparation for hibernation.

TELENGA (N. A.). **Investigations on** *Trichogramma evanescens* **Westw. and** *T. pallida* **Meyer (Hymenoptera, Trichogrammatidae) and their Use for the Control of injurious Insects in the USSR.** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 3 pp. 599–610, 13 refs. Moscow, 1956. (With a Summary in English.)

Three species of *Trichogramma* are known to parasitise the eggs of crop pests in the Soviet Union, *T. evanescens* Westw., *T. fasciatum* (Perkins) and *T. pallidum* Meïer. *T. evanescens*, of which the bionomics, ecology and hosts are reviewed from the Russian literature [*cf. R.A.E.*, A **30** 144, 298, 373; **33** 306], is reared on a large scale in the eggs of *Sitotroga* [*cerealella* (Ol.)] at varying daily temperatures, rearing at constant optimum temperature reducing its effectiveness on release, and liberated against various insects, notably *Agrotis segetum* (Schiff.) in grain fields in European Russia. Liberation at the rate of 4,000–8,000 individuals per acre reduces the numbers of this pest by 70–80 per cent. *T. fasciatum* parasitises the eggs of *Cydia pomonella* (L.), but little is known of its bionomics [*cf.* **5** 155]. *T. pallidum* attacks the eggs of *C. pomonella* [*cf.* **29** 581; **30** 298] and other Lepidopterous pests of fruit trees, and investigations on it were begun in the Ukraine in 1953.

T. pallidum was found to overwinter in the eggs of *Orgyia antiqua* (L.) and *Malacosoma neustria* (L.), and to be adapted for life in areas covered with trees. It frequents all parts of the crown, flies readily and when released against *C. pomonella* at the rate of 1,000 adults per tree, it spread about 55 yards in a month. Populations from the forest-steppe zone were shown to have a higher fecundity and to parasitise a greater percentage of the eggs of *Sitotroga* in the laboratory than those from the steppe zone. There were 8–9 generations a year near Kiev, and the duration of development varied from 11 days at an average daily temperature of 23·5°C. [74·3°F.] to 27 days at 12·7°C. [54·9°F.]. When individual females were confined with eggs of *Sitotroga* in the laboratory at various temperatures and a relative humidity of 75 per cent., 41·4 per cent. of the eggs were parasitised and an average of 37·8 adult offspring per female was obtained when the temperature was 20°C. [68°F.] at night and 25°C. [77°F.] by day, the corresponding figures being 36·8 and 33·3, respectively, at 18–20°C. [64–68°F.] and 40·6 and 36·1 at 25°C. The ratio of males to females was 1 : 4, the proportion of females decreasing when the relative humidity dropped to 40 per cent. Eggs of *Sitotroga* were not very attractive for oviposition; 70 per cent. of the females oviposited in them at a relative humidity of 75 per cent., but only 40 per cent. did so at a humidity of 40 per cent.

When the parasitised eggs were kept at 3–4°C. [37·4–39·2°F.] for 5–6 months, only 7–9 per cent. of them gave rise to adult parasites, whereas 30–40 per cent. did so when they were kept at 0–3°C. [32–37·4°F.]. The rate of emergence was higher after hibernation in the field.

Observations in the forest-steppe zone, where there is abundant rainfall, showed that *T. pallidum* afforded an average of 75 per cent. parasitism of the eggs of *C. pomonella* and other Lepidoptera. It was favoured by the presence of wind-breaks and disfavoured by the use of DDT sprays. It was scarce in the dry steppe zone, where the adults emerge in spring about a month earlier than those of *C. pomonella* and there is a lack of alternative hosts, but is released there at the rate of 8,000 per acre every year and affords about 5–10 per cent. parasitism within six weeks of liberation and up to 50–70 per cent. later in the season. When release of the parasite in this district is supplemented by other control measures, about 95 per cent. of apple fruits are protected from infestation by *C. pomonella*.

KALANDADZE (L. P.). **Development of the injurious Insect Fauna of the Tea Plant in the USSR.** [*In Russian.*]—*Rev. Ent. URSS* **35** pt. 3 pp. 637–647, 35 refs. Moscow, 1956. (With a Summary in English.)

A list is given of 44 insects that injure tea in the Georgian Republic, where this crop has been cultivated for over a century, showing their degree of food-plant specialisation and whether they are introduced or indigenous, and earlier lists are reproduced to illustrate the historical development of this pest complex. Two shorter lists show the insects that attack the crop in Azerbaijan and the Province of Krasnodar, where it has been grown for not more than about 20 years. The most injurious of the various species concerned are *Toxoptera aurantii* (Boy.) [*cf. R.A.E.*, A **30** 138], Coccids, of which *Pulvinaria floccifera* (Westw.) [*cf.* **45** 472] is by far the most important, the Melolonthid, *Maladera japonica* (Motsch.), and the Coleophorid, *Parametriotes theae* Kusnetsov [*cf.* **19** 238], of which the last two occur in Georgia and the others also in Azerbaijan. Notes are given on their distribution, food-plant preferences and control. An emulsion spray of 0·06–0·09 per cent. parathion gives excellent control of *P. theae*, and fumigation with hydrogen cyanide is widely practised against the Coccids, against some of which introduced natural enemies have been released.

BLANCHARD (E. E.). **Nuevos sarcofágidos acridiófagos argentinos (Diptera).** [New Argentine Sarcophagid Parasites of Acridids.]—*Rev. Soc. ent. argent.* **18** (1955) no. 3–4 pp. 27–34, 3 figs., 1 ref. Buenos Aires, 1956.

Two of the new Sarcophagids described are parasites of *Dichroplus maculipennis* (Blanch.). They are *Parahypopelta salavini*, gen. et sp. n., from southern Argentina, and *Protodexia liebermanni*, sp. n., from Chile and also from southern Argentina [*cf. R.A.E.*, A **40** 299].

BLANCHARD (E. E.). **Un nuevo género y especie de eupelmido coccidofago (Hymenoptera).** [A new Eupelmid parasitising a Coccid.]—*An. Soc. cient. argent.* **162** pt. 5–6 pp. 160–164, 1 fig., 2 refs. Buenos Aires, 1956.

Cordyloodera incognita, gen. et sp. n., is described from three females reared from eggs of *Ceroplastes grandis* Hemp. in Argentina. It is the Eupelmid recently recorded attacking this Coccid there by Griot [*R.A.E.*, A **44** 302].

FLOCK (R. A.) & WALLACE (J. M.). **Transmission of Fig Mosaic by the Eriophyid Mite** *Aceria ficus*.—*Phytopathology* **45** no. 1 pp. 52–54, 2 figs., 10 refs. Baltimore, Md., 1955.

The following is based on the authors' summary. An account is given of experiments in California showing that mosaic-like symptoms on fig result from infection with a virus that is transmitted by *Aceria* (*Eriophyes*) *ficus* (Cotte), and not from toxicogenic feeding by this mite [*cf. R.A.E.*, A **22** 31–32; **28** 83]. Uninfected mites proved highly injurious to seedling fig trees, but did not cause typical mosaic symptoms. The virus was found to occur in all the fig trees examined in the field, which made estimation of the resulting loss of production difficult.

SLYKHUIS (J. T.). *Aceria tulipae* **Keifer (Acarina: Eriophyidae) in Relation to the Spread of Wheat Streak Mosaic.**—*Phytopathology* **45** no. 3 pp. 116–128, 4 figs., 13 refs. Baltimore, Md., 1955.

An account is given of investigations in Canada on the transmission of the virus of wheat streak mosaic by the Eriophyid, *Aceria tulipae* (Keifer) [*cf. R.A.E.*, A **43** 277, etc.], and the following is based on the author's summary of the results.

The mite proved an efficient vector of the virus and evidence was obtained that it often carries an additional factor, possibly also a virus, that causes severe chlorosis, necrosis and stunting of wheat and is not transmitted by manual inoculation. The mites themselves caused a longitudinal rolling of wheat leaves, but no chlorosis unless they became numerous. When *A. tulipae* was reared on infected wheat, all stages except the egg were found infected. The nymphs in both instars acquired the virus, but not the adults, and the virus persisted in the vector for at least six days.

Wind was shown to be a major factor in the dispersal of the mite and hence of the mosaic virus [*cf.* **45** 417, etc.]. The mite transmitted it to numerous graminaceous plants [*cf.* **45** 91], including maize, which was more readily infected by means of it than by manual inoculation, but wheat was the most favourable of the many food-plants on which the mite was reared. All stages survived the winter on winter wheat, and the mites survived lower temperatures than hardy varieties of winter wheat artificially hardened and exposed to controlled sub-freezing temperatures.

Indications have been obtained that infestation can be eliminated by the destruction of infested wheat plants by soil cultivation, but the mites survived long enough on infested leaves buried in or placed on the soil to infest wheat sown six days later. They soon died on leaves that became desiccated or partly decomposed, so that the rate of elimination was affected by soil temperature and moisture.

MARAMOROSCH (K.). **Mechanical Transmission of California Celery-yellows Virus to Aster Leafhoppers.** (Abstract.)—*Phytopathology* **45** no. 3 p. 185. Baltimore, Md., 1955.

In laboratory tests, the California celery-yellows strain of the aster-yellows virus was transmitted mechanically to *Macrosteles fascifrons* (Stål) by needle-inoculation of material obtained from infected examples of this Cicadellid. Of 35 insects so treated, 17 survived for more than 14 days, and six of these transmitted the virus to aster [*Callistephus chinensis*].

Simons (J. N.). **Some Plant-Vector-Virus Relationships of Southern Cucumber Mosaic Virus.**—*Phytopathology* **45** no. 4 pp. 217–219, 2 graphs, 5 refs. Baltimore, Md., 1955.

The following is based on the author's summary. In experiments, the virus of southern cucumber mosaic (southern celery mosaic), which causes a severe disease of both celery and pepper [*Capsicum*] in southern Florida, was transmitted from celery to celery by *Aphis gossypii* Glov. and *Myzus persicae* (Sulz.) and to pepper by these two Aphids and *Aphis fabae* Scop. (*rumicis*, auct.), in decreasing order of efficiency. The acquisition threshold period for the first two was 5–10 seconds. In tests with *M. persicae*, pepper was superior to Swiss chard for rearing the Aphids and more susceptible as a test plant in transmission experiments, whereas Swiss chard was a better source of the virus. The mean length of the initial naturally-terminated feeding period was 14·5 seconds, and the maximum percentage of Aphids became infected in that time.

Frazier (N. W.). **Strawberry Vein Banding Virus.**—*Phytopathology* **45** no. 6 pp. 307–312, 1 fig., 9 refs. Baltimore, Md., 1955.

The following is based on the author's summary. A vein-banding virus was isolated from strawberry plants in California in 1949. In tests, it was transmitted by dodder (*Cuscuta subinclusa*), by grafting, and by the Aphids, *Amphorophora rubi* (Kalt.), *Capitophorus fragaefolii* (Ckll.), *Macrosiphum pelargonii* (Kalt.) and *Myzus ornatus* Laing, but not by *Aphis fabae* Scop. (*rumicis*, auct.), *A. gossypii* Glov., *Macrosiphum solani* (Kalt.) or *M. solanifolii* (Ashm.). Six colonies of *C. fragaefolii* differed in ability to transmit, two failing to do so. The incubation period in the plants was usually about three weeks. The virus was acquired by *C. fragaefolii* during feeding periods of 30, but not 20, minutes, and the numbers that became infected were small for feeding periods of up to an hour, but increased sharply for longer periods of up to two hours. It was transmitted to the first test plant within a feeding period of 30 minutes following acquisition, and it was retained for eight but not 24 hours by Aphids that had completed acquisition feeding periods of 1–4 days. Transmission was less successful after a 4-day acquisition feeding period than after one of one day. Varying the frequency of serial test feeding periods did not affect the maximum period of virus retention, and the percentage of transmission increased with increased test feeding periods.

KenKnight (G.) & Jones (J.). **Role of Black Peach Aphid in Spread of Crown Gall.** (Abstract.)—*Phytopathology* **45** no. 6 p. 349. Baltimore, Md., 1955.

Observations in Georgia are recorded showing an apparent association between the activities of the black peach Aphid [*Anuraphis persicae-niger* (Smith)] and the occurrence of crown galls on peach trees.

Sylvester (E. S.). **Lettuce Mosaic Virus Transmission by the Green Peach Aphid.**—*Phytopathology* **45** no. 7 pp. 357–370, 1 graph, 67 refs. Baltimore, Md., 1955.

Lettuce mosaic has caused losses in lettuce-producing areas in Britain [*cf. R.A.E.*, A **40** 39] and the United States. The principal vector of the virus in the field is *Myzus persicae* (Sulz.), but other Aphids may also be involved [*cf. loc. cit.*]. Experiments were carried out in California on its transmission by *M. persicae*, and the following is based partly on the author's summary of the results. The threshold acquisition period for Aphids feeding on infected lettuce was 11–15 seconds, and efficiency of transmission increased directly with length of acquisition feeding periods up to 30 seconds. It also increased with preliminary fasting periods up to four hours, the gain in efficiency being greatest in the first 30 minutes of fasting and decreasing thereafter. The virus was retained longer by fasting than by feeding Aphids. Increasing the feeding periods on a virus source from 5 to 120 minutes caused a decrease in transmission efficiency, but the rate of loss of infectivity was lower than for comparable periods on virus-free plants. Serial transmission occurred when the test feeding periods on the healthy plants were short, and 1–4 plants were infected per Aphid, with a mean of 1·3. There was no difference in transmission when the Aphids fed on the leaves or cotyledons of the healthy test plants or the upper or lower surfaces of these. Lowering the temperature from 23°C. [73·4°F.] to 6°C. [42·8°F.] decreased the effect of preliminary fasting on subsequent transmission. Alates proved less efficient vectors than apterae or nymphs.

Some indication was found that the plant on which the Aphids are reared has an influence on virus transmission. Placing test plants in the dark for 48 hours before infective Aphids fed on them increased their susceptibility to infection, but pretreatment of infected plants with short periods of cold or darkness or both did not affect transmission from them. Trials with healthy test plants 1–5 weeks of age resulted in more infections in the older than in the younger plants. It is concluded that the virus is of the non-persistent type.

Skotland (C. B.) & Hagedorn (D. J.). **Vector-feeding and Plant-tissue Relationships in the Transmission of the Wisconsin Pea Streak Virus.**—*Phytopathology* **45** no. 12 pp. 665–666, 1 fig., 8 refs. Baltimore, Md., 1955.

The following is virtually the authors' summary. Studies of the feeding habits and plant-tissue relationships of *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)) were made in an attempt to determine the cause of the low efficiency of this insect as a vector of the Wisconsin pea-streak virus [*cf. R.A.E.*, A **43** 270]. It was found that the Aphid sought out the phloem to feed in and that penetration of plant tissue was primarily intercellular. The insect fed on the phloem as regularly in diseased as in healthy tissue. It rarely transmitted the virus, whether it fed in phloem or parenchyma. The data suggest that the virus is rarely transmitted by the Aphid because this insect is largely an intercellular feeder.

Muesebeck (C. F. W.). **On *Opius ferrugineus* Gahan and two closely similar new Species (Hymenoptera: Braconidae).**—*Ent. News* **67** no. 4 pp. 99–102. Lancaster, Pa., 1956.

Descriptions are given of the adults of both sexes of *Opius alloeus*, sp. n., reared from *Rhagoletis pomonella* (Walsh), in the eastern United States, and of the female of *O. muliebris*, sp. n., from the western race of the cherry fruit-fly (*R. cingulata indifferens* Curr.) [*cf. R.A.E.*, A **45** 153] in Washington State. *O. muliebris* is apparently parthenogenetic, no males being known, and it is also recorded from *R. c. indifferens* in Oregon, *Rhagoletis* on *Prunus emarginata* in California, and wild cherry fruit-fly pupae in Oregon. It was previously confused with *O. ferrugineus* Gah.

[*cf.* **45** 152]. Notes are included on the morphology of the true *O. ferrugineus*, which is a parasite of the typical *R. c. cingulata* (Lw.) in the eastern United States, and a key is given permitting differentiation of the three species of *Opius* considered.

MIDDLEKAUFF (W. W.). **A new Parasite Record for the Lima Bean Pod Borer in California (Lepidoptera, Pyralidae).**—*Proc. ent. Soc. Wash.* **58** no. 2 p. 104. Washington, D.C., 1956.

Lima beans grown in Ventura County, California, in 1954 were found on examination in 1955 to have been infested by *Etiella zinckenella* (Treitschke). When the beans were split, four adults of *Cephalonomia gallicola* (Ashm.) were found between the cotyledons and several cocoons of this Bethylid were embedded in the frass. It is concluded that the larvae of *E. zinckenella* had been parasitised by *C. gallicola*.

FREEMAN (T. N.). **Two new Species of the Genus** *Recurvaria* **Haw. (Lepidoptera: Gelechiidae).**—*Pan-Pacif. Ent.* **33** no. 1 pp. 9–13, 8 figs. San Francisco, Cal., 1957.

Descriptions are given of the adults and male genitalia of *Recurvaria starki* and *R. canusella*, spp. n., based on examples reared from lodgepole pine (*Pinus contorta*) in Alberta and British Columbia, respectively. Both have been confused with *R. milleri* Busck, which infests the same tree but is known only from the Yosemite and Sequoia National Parks in California. *R. starki* is stated to have been included among the moths referred to *R. milleri* in papers by Hopping [*R.A.E.*, A **35** 59] and McLeod [**40** 377], and to be the species studied by Stark [**43** 303]. Both mine the needles of the food-plant, but *R. starki* completes its life-cycle in two years and *R. canusella* apparently in only one.

MICHELBACHER (A. E.) & HITCHCOCK (S.). **Calico Scale,** *Lecanium cerasorum* **Cockerell on Walnuts.**—*Pan-Pacif. Ent.* **33** no. 1 pp. 15–18, 1 fig., 2 refs. San Francisco, Cal., 1957.

Some Lecaniines, notably *Eulecanium* (*Lecanium*) *pruinosum* (Coq.), have increased on walnut in California as a result of the destruction of their natural enemies by sprays of DDT or other modern insecticides applied for the control of other pests [*cf. R.A.E.*, A **45** 90]. *E.* (*L.*) *cerasorum* (Ckll.) has not so increased, and observations in sprayed walnut orchards showed that this was due to extensive destruction of the Coccids in spring by the Audubon warbler. The bird remained in the orchards until mid-April, and almost all individuals left by it were found to be parasitised by *Blastothrix longipennis* How.

JENSEN (D. D.). **The** *Albizzia* **Psyllid,** *Psylla uncatoides* **(Ferris & Klyver), in California (Homoptera: Psyllidae).**—*Pan-Pacif. Ent.* **33** no. 1 pp. 29–30, 4 refs. San Francisco, Cal., 1957.

Psyllids found widely distributed on *Albizzia* and *Acacia* in California in 1954–56 were identified as *Psylla uncatoides* (Ferris & Klyver), which was previously known only from New Zealand.

FRICK (K. E.). **Nearctic Species in the *Liriomyza pusilla* Complex. No. 2. *L. munda* and two other Species attacking Crops in California (Diptera: Agromyzidae).**—*Pan-Pacif. Ent.* **33** no. 2 pp. 59–70, 1 fig., 13 refs. San Francisco, Cal., 1957.

The species considered in this part of a series [*cf. R.A.E.*, A **45** 406] are *Liriomyza munda*, sp. n., *L. propepusilla* Frost [*cf. loc. cit.*], *L. pictella* (Thoms.), which is transferred from *Agromyza*, and *L. brassicae* (Ril.). *L. munda* is described from adults of both sexes reared from tomato leaves in California and is also recorded as infesting potato and *Datura meteloides* and as swept from tobacco in the same State. It has been misidentified on tomato as *L. pusilla* (Mg.) and also as *L. propepusilla* (*subpusilla* (Frost)) [**41** 265]. *L. propepusilla* is here restricted to the holotype male, which was taken by sweeping in Kansas, and does not apparently occur in California. The male of *L. pictella* is redescribed. The identity of this species has long been in doubt. It is common in California, where it infests plants in six families, including lucerne, other leguminous crops, cotton, and cucurbits. *L. brassicae* occurs in the United States and Canada and has also been recorded from Hawaii. It infests various cruciferous plants and nasturtium (*Tropaeolum*), and is probably the species recorded by Frost [**34** 57] as infesting these plants in the United States. Characters by which *L. munda*, *L. brassicae* and *L. pictella* can be differentiated are shown in a table.

STONE (M. W.). **Notes on the Biology of three Elaterids injurious to Vegetable Crops (Coleoptera).**—*Pan-Pacif. Ent.* **33** no. 2 pp. 79–85, 3 figs., 4 refs. San Francisco, Cal., 1957.

Damage is caused to lima beans and other vegetables in southern California by the larvae of *Limonius californicus* (Mannh.), *Melanotus longulus* (Lec.), *Drasterius livens* (Lec.), *Cardiophorus tenebrosus* Lec. and *Anchastus cinereipennis* (Eschscholtz). During investigations on the bionomics of the first two of these wireworms, incomplete observations were made on those of the other three, mainly in 1932–34. The life-cycle of *D. livens* lasted one or two years. The eggs hatched in 25–34 days, during May, and the larvae pupated either in August–September of the same year, giving rise to adults in September, or in June–July of the following year, the adults emerging between late June and mid-August. Field-collected females laid 15–17 eggs each. Females of *C. tenebrosus* laid 82–198 eggs each, between mid-March and mid-April. The larvae hatched in 30–39 days, but were not reared to maturity. Field-collected females of *A. cinereipennis* laid 45–123 eggs, in April. The larvae hatched in an average of 27 days, in late April and early May, and pupated in September of the following year. Adults emerged in October, the life-cycle thus requiring two years.

GLICK (P. A.). **Collecting Insects by Airplane in southern Texas.**—*Tech. Bull. U. S. Dep. Agric.* no. 1158, 28 pp., 9 figs., 12 refs. Washington, D.C., 1957.

The full results are given of investigations in Texas in 1954 on the occurrence of *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) and other insects in the upper air [*cf. R.A.E.*, A **45** 30]. In all, 33 spiders and 1,340 insects were taken in the traps installed on the aeroplane, mostly at altitudes of up to 200 ft. In addition to 12 examples of *P. gossypiella* [*cf. loc. cit.*], they included one of *Empoasca fabae* (Harris), at 500 ft., and four of *E. abrupta* DeL., at up to 5,000 ft.; both these Cicadellids occur on cotton in Texas, Louisiana and Georgia. Two examples of the boll weevil (*Anthonomus grandis* Boh.) were taken at 200–500 ft.

Hurtig (H.), Mann (S. L. W.), Hopewell (W. W.) & Gravells (R.). **A new Technique for sampling and assessing aerial Spray Deposits.**—*Canad. J. agric. Sci.* **36** no. 2 pp. 81–94, 1 pl., 2 graphs, 8 refs. Ottawa, 1956.

The following is almost entirely the authors' abstract. Printflex paper cards (glossy white cards sized with casein and finished with a mixture of calcium sulphate and calcium carbonate) were found to provide a satisfactory surface for collecting samples of aerial sprays for the assessment of spray deposits. The spread factor for an oil solution of an insecticide on them is not constant for the various droplet sizes, and the factors for dyed and undyed solutions of DDT in oil, on undyed and dyed paper, ranged from 3·6 to 6·2 for corresponding stains produced by droplets in the range 60 to 600 μ. A new rapid photographic method of quantitative assessment of the deposit on the cards is described, in which a high-contrast, light-weight photographic paper is used instead of film. The process provides a permanent record of the stains, enlarged 3·5 ×, with a suitable calibration grid recorded on the print. The assessment can be carried out without any further optical aids. Statistical analysis showed that density of deposit, number of droplets per unit area, and mass median diameters of the spray sample can be determined with a high degree of accuracy by these methods. In two field trials, they were found to be comparable in accuracy with other sampling and assessment methods.

Anderson (J. M.) & Fisher (K. C.). **Repellency and Host Specificity in the White Pine Weevil.**—*Physiol. Zoöl.* **29** no. 4 pp. 314–324, 2 figs., 11 refs. Chicago, Ill., 1956.

The following is based almost entirely on the authors' summary. The reactions of adults of *Pissodes strobi* (Peck) to the odours emitted by the ground-up bark of several coniferous trees were studied in a new form of olfactometer, in which the test organism is placed on a horizontal plastic screen through which three concentric air masses pass from below. In the experiments described, the test odours were added to the second of the three air masses, and a quantitative measure of the response was provided by the time, referred to as the "traversal time," required for the insect to crawl from the centre of the innermost air mass to the outer edge of the second air mass. The traversal times in experiments with *Picea abies* (*excelsa*), *P. obovata* and *P. asperata* did not differ significantly from the controls. The traversal times in experiments with *P. glauca*, *P. rubens*, *P. mariana* and *Pinus strobus*, however, were significantly longer than the control traversal times, indicating a repellent effect of the odours emanating from them.

Especially when the traversal times were long, there were periods during which the insects did not move at all, but the fraction of the traversal time spent at rest was not appreciably greater when the traversal time was long than when it was short. It is concluded that the repellent effect of an odour was not to change the amount of locomotion but rather to confine it to the restricted area of the inner air mass. The odours operated apparently by affecting the direction of the locomotion.

The relative frequency with which trees of the species tested were attacked by the weevil in the field was determined in an experimental plantation in Ontario. Except in the case of *Pinus strobus*, which was heavily infested, there was a close correlation between susceptibility to attack and the results of the experiments, trees that were repellent in the laboratory generally being only lightly infested in the field. In view of the result with *P.*

strobus, however, it is concluded that although repellency may be of importance in determining susceptibility, other factors must also be involved.

HANDFORD (R. H.). **Grasshopper Population Sampling.**—*Proc. ent. Soc. B.C.* **52** (1955) pp. 3–8, 11 refs. Vernon, B.C., 1956.

The author describes the purpose of the annual grasshopper surveys that are carried out in Canada and the United States, gives details of the different techniques necessary for sampling the eggs of *Melanoplus mexicanus mexicanus* (Sauss.), the eggs of *Camnula pellucida* (Scudd.) and grasshopper nymphs and adults, and discusses the problems encountered in the work, including the effect of variations in environmental factors, such as vegetation and weather, and personal bias in the selection of samples.

MACCARTHY (H. R.). **Insect Populations in Cariboo Potato Fields.**—*Proc. ent. Soc. B.C.* **52** (1955) pp. 8–11, 2 graphs. Vernon, B.C., 1956.

Comparative freedom from virus-carrying insects has led to the establishment of a thriving seed-potato industry in the Cariboo district of British Columbia, where *Myzus persicae* (Sulz.) is rare and insecticides are seldom applied. Insect populations were sampled regularly on three farms, ten miles apart, near Soda Creek, from late June to early September in 1951, 1952 and 1953 in an attempt to correlate insect numbers, particularly those of Cicadellids, with the frequency of the witches'-broom disease of potato, but little or no virus infection was observed. The populations were similar in corresponding weeks in the three years, and 91 per cent. of all the insects taken were adults of *Epitrix subcrinita* (Lec.), which has become established in the area since 1949 [*cf. R.A.E.*, A **42** 93]. The flea-beetles were most numerous in small, unirrigated fields and surrounding wasteland and reached their peak in early September. *Macrosiphum solanifolii* (Ashm.) was the predominant Aphid taken. Populations of *Empoasca* spp. were highest in late summer, particularly in large, well irrigated fields, but caused little damage. The other Cicadellids taken included *Macrosteles* spp. and *Scaphytopius dubius* (Van D.) [*cf.* **39** 402]. Other insects of minor importance are also recorded, and population graphs are given for the various species or groups. They indicate that the best time for a single application of a general insecticide would probably be the last week in July, when most of the insects are increasing in numbers as the first summer generation matures. Treatment in mid-July would also be effective, especially against *Epitrix subcrinita*, damage by which is caused chiefly by the larvae that hatch from eggs laid by adults emerging in mid-August; it would also control Aphids, but a second application would probably be required against them after about a month.

PROVERBS (M. D.). **Chemical Control of *Lygus* spp. (Hemiptera: Miridae) in British Columbia Peach Orchards.**—*Proc. ent. Soc. B.C.* **52** (1955) pp. 22–26, 2 refs. Vernon, B.C., 1956.

Until 1949, peaches grown in the interior of British Columbia were appreciably damaged by the feeding of *Lygus* spp., which were particularly abundant in orchards in which lucerne cover crops were present. Investigations on the control of the Mirids by means of insecticides were carried out in the Okanagan Valley in 1947–52. In the first year, dusting the cover crop with about 80 lb. 3 per cent. DDT per acre when the trees were at the balloon-bud stage caused an appreciable reduction in the proportion of malformed fruits, whereas dusting with 3 per cent. DDT or 2 per cent. γ BHC at the early balloon-bud stage did not [*cf. R.A.E.*, A **37** 359]. In subsequent tests, in which the peach trees themselves were sprayed, generally with a mist-blower, DDT, applied at 5–9 lb. per acre, with stove oil and Velsicol AR-50 (a methylated naphthalene), at 90 per cent. petal-fall and again, at 6 lb. per acre, in similar sprays at 90 per cent. sepal-fall gave very good results; a single application at petal-fall was almost as effective, and the second application did not justify its cost. Wettable BHC, applied with oil and Velsicol AR-50 at 95 per cent. petal-fall and again at 95 per cent. sepal-fall, to give 0·75 lb. γ isomer per acre, also caused considerable reduction in fruit injury, and appeared more effective than DDT, but a strict comparison could not be made. At 75 per cent. petal-fall, 7 lb. wettable parathion per acre was slightly more effective than 15 lb. wettable DDT. There was no evidence that the use of DDT resulted in an increase of phytophagous mites.

ARNOTT (D. A.). **Some Factors reducing Carrot Seed Yields in British Columbia.**—*Proc. ent. Soc. B.C.* **52** (1955) pp. 27–30, 12 refs. Vernon, B.C., 1956.

A Mirid collected in fields of carrot grown for seed in the Grand Forks district of British Columbia in 1952 was identified as *Lygus scutellatus* (Uhl.), and it is considered likely that this species was responsible for the severe infestations of 1947 and 1948, and not *L. campestris* (L.), as then reported [*cf. R.A.E.*, A **38** 183–184], since there is now much doubt whether the latter occurs in North America. *L. scutellatus* has not since proved very injurious, but it is common and widely distributed throughout the southern interior of British Columbia, where it breeds on several wild umbelliferous plants and also infests seed crops of parsnip and dill, and further outbreaks are therefore likely. Other species of *Lygus* also reduced seed yields when caged on carrot, but have not proved injurious in the field. Since 1948, seed losses have been due mainly to diseases, and notes on these are included.

HODSON (A. C.) & BROOKS (M. A.). **The Frass of certain Defoliators of Forest Trees in the North Central United States and Canada.**—*Canad. Ent.* **88** no. 2 pp. 62–68, 1 fig., 20 refs. Ottawa, 1956.

Use has been made in recent years of the frass produced by insect pests of forests for the determination of the species present and their abundance, the course of larval development and survival during outbreaks, and the effectiveness of insecticide treatments [*cf. R.A.E.*, A **40** 158, etc.], and a key is here given for the differentiation of the frass produced by the last-instar larvae of upwards of 50 species of Lepidoptera and sawflies that commonly defoliate forest and shade trees in Canada and the north-central United States. A few groups of two or three species, usually closely related, could not be further differentiated, and separation could not be carried out in others much beyond the family.

MONTEITH (A. E.). *Phygadeuon trichops* **Thoms. (Hymenoptera: Ichneumonidae), an occasional Parasite of** *Hylemya* **spp. (Diptera: Anthomyiidae).**—*Canad. Ent.* **88** no. 2 pp. 69–73, 8 figs., 10 refs. Ottawa, 1956.

During surveys of the parasites that attack *Hylemyia brassicae* (Bch.), *H. floralis* (Fall.) and *H. cilicrura* (Rond.) on cruciferous crops in Canada and Europe, some of the results of which have already been noticed [*cf. R.A.E.*, A **42** 170; **43** 434], *Phygadeuon trichops* Thoms. was collected in Norway, Holland and Scotland, but in such small numbers as to indicate that *Hylemyia* spp. are not its main hosts. The following is taken from the author's summary of this account of studies on the bionomics of the Ichneumonid in the laboratory, where it attacked all three species and also *H. antiqua* (Mg.). The females deposited their eggs on the host pupa within the puparium. They did not discriminate between parasitised and unparasitised puparia; superparasitism was common, but only one parasite survived to the adult stage. Development from egg to adult required about 20 days. The last-instar larva formed a cocoon within the host puparium, and winter was passed in this stage, with no true diapause.

LLOYD (D. C.). **Studies of Parasite Oviposition Behaviour. I.** *Mastrus carpocapsae* **Cushman (Hymenoptera: Ichneumonidae).**—*Canad. Ent.* **88** no. 2 pp. 80–89, 23 refs. Ottawa, 1956.

The following is largely the author's summary. The results are given of laboratory observations on the oviposition behaviour of *Mastrus carpocapsae* (Cushm.), a solitary external parasite that attacks the larvae of *Cydia* (*Carpocapsa*) *pomonella* (L.) in their cocoons in California and elsewhere. The females discriminated between unparasitised and parasitised hosts. In the presence of normal, unparasitised hosts, they usually avoided ovipositing on hosts bearing parasite eggs, hosts that were paralysed, but not parasitised, and hosts that had been killed by immersion for two minutes in water at 55°C. [131°F.]. Deterrent factors limiting superparasitism were found to be related to the condition of the host larvae rather than to the condition of the surface of the cocoon. The rejection of parasitised hosts is apparently caused by stimuli other than those due to previous oviposition or the presence of immature parasite stages on the host larvae. The similarity in behaviour shown by the ovipositing females towards paralysed and coddled hosts indicates that discrimination may be on the basis of sound, with host paralysis an intrinsic component of the discriminative mechanism. It is recognised that other host characteristics may be involved and the response be one to multiple stimuli. The bearing of the results on previous demonstrations of excessive superparasitism in external parasites [*cf. R.A.E.*, A **29** 490; **37** 55] is discussed.

HILL (A. R.). **Observations on the North American Form of** *Amphorophora rubi* **Kalt. (Homoptera, Aphididae).**—*Canad. Ent.* **88** no. 2 pp. 89–91, 3 refs. Ottawa, 1956.

The Lloyd George variety of raspberry was reported to be totally resistant to infestation by *Amphorophora rubi* (Kalt.) in the United States [*cf. R.A.E.*, A **28** 583], but susceptible to it in Britain, where another variety, Malling Promise, about equalled it in susceptibility and a third, Malling Landmark, was almost completely resistant [*cf.* **45** 418]. In a test in British Columbia in June 1955, a late last-instar nymph of *A. rubi* was confined on a young leaf on a plant of each of these three varieties grown from root cuttings obtained from Scotland. After 12 days, the numbers of progeny on the leaves from Lloyd George, Malling Promise and Malling Landmark were 0, 3 and 46, respectively. It is concluded from these results that the strain of *A. rubi* in North America differs from that present in Europe [*cf.* **28** 583].

Wood (G. W.) & Neilson (W. T. A.). **Notes on the Black Army Cutworm, *Actebia fennica* (Tausch.) (Lepidoptera: Phalaenidae), a Pest of Low-bush Blueberry in New Brunswick.**—*Canad. Ent.* **88** no. 3 pp. 93–96, 10 refs. Ottawa, 1956.

Actebia fennica (Tauscher) is the chief pest attacking the foliage of low-bush blueberry in New Brunswick, where it periodically occurs in outbreak numbers and may then completely destroy the crop. It has remained scarce since the outbreak in 1944–45 [*R.A.E.*, A **38** 399], but its potential importance has increased as a result of the expansion of blueberry cultivation in eastern Canada. The eggs and larvae are described, and an account is given of the bionomics of the Noctuid, based on observations during 1946–54. There is one generation a year. The larvae overwinter in the soil in the first or second instar and resume activity in mid-April, feeding on the buds and later on the flowers and foliage. The damage to the buds is the most important and is frequently overlooked because the outer bud scales are left intact. Pupation occurs in the second half of June. In the insectary, the pupal stage lasted 16–37 days, and males and females emerged in equal numbers in late July and August (when they also appeared in the field), paired in the second week after emergence, and survived for up to six weeks. Females oviposited within two days of pairing and laid a mean of 161 eggs each, with a maximum of 421. The eggs hatched in mid-October, after 58–78 days, and the first-instar larvae fed on blueberry and *Kalmia angustifolia* until early November. In the field, little feeding takes place in autumn. Parasitism among field-collected larvae ranged from 7·4 to 74·1 per cent. Much the most important parasite was *Arenetra canadensis* Cress., an Ichneumonid of which the larvae leave the fully fed host larvae between early June and early July, pupate within three days, and give rise to adults towards the end of the following April. The others were *Poecilanthrax tegminipennis* (Say), *Nepiera marginata* (Prov.) and *Rogas* sp., but they were not observed every year.

Lilly (C. E.) & Hobbs (G. A.). **Biology of the Superb Plant Bug, *Adelphocoris superbus* (Uhl.) (Hemiptera: Miridae), in southern Alberta.**—*Canad. Ent.* **88** no. 3 pp. 118–125, 5 figs., 6 refs. Ottawa, 1956.

Adelphocoris superbus (Uhl.) is a serious pest of lucerne grown for seed in an irrigated district in southern Alberta, killing the unopened flower buds and, when numerous, preventing the production of enough flowers for the maintenance of the local pollinating insects. In Utah, it has been reduced to non-economic proportions by cutting first-growth lucerne for hay [*cf. R.A.E.*, A **35** 45], but in Alberta, where the growing season is shorter, seed must be taken from the first crop and the Mirid is therefore likely to remain of importance. Its bionomics were studied in the field and laboratory in 1951–53, and the following is based on the authors' summary of the results. The females oviposit in autumn in square, non-lignified portions of lucerne stems with an average width of about 1 mm., and terminal portions of older plants and spindly second growth are preferred. The eggs apparently enter diapause soon after they are laid, and show no sign of development until the following spring. Hatching usually becomes general early in June and continues for over a month. Although some individuals become adult by 2nd July and gravid females are found from mid-July until after mid-September, there is only one generation a year. Because of this and because the eggs are laid in terminal growth, *A. superbus* becomes injurious only in fields in which cultural operations do not destroy the young nymphs or overwintered eggs and is not common in hay fields or on seed crops on plants that have been burned in the spring. *Sinea diadema* (F.) and

Phymata fasciata (Gray) are important predators of the Mirid in this region. Lucerne is its principal food-plant, but it was also observed breeding on *Cirsium arvense*. Although there is no morphological difference between examples taken in southern Alberta and Utah [*loc. cit.*], the absence of a second generation in Alberta appears to indicate the existence of different physiological strains.

LORD (F. T.). **The Influence of Spray Programs on the Fauna of Apple Orchards in Nova Scotia. IX. Studies on Means of altering Predator Populations.**—*Canad. Ent.* **88** no. 3 pp. 129–137, 5 figs., 4 refs. Ottawa, 1956.

This part of a series dealing with long-term investigations of the effects of sprays on the arthropod fauna of apple orchards in Nova Scotia [*cf. R.A.E.*, A **45** 54, etc.] contains a preliminary report of work carried out in 1953–54 in an attempt to alter the populations of certain insects that prey on phytophagous mites and to study the interactions of the mites with various groups of predators. The following is largely the author's summary of the work. DDT was applied at concentrations of 0·25–2 lb. per 100 gals. at several periods of the growing season in 1953 to disrupt relations between mites and their predators in a series of apple plots in which the mites were almost exclusively *Metatetranychus ulmi* (Koch) and *Bryobia praetiosa* Koch and the principal predators were *Anthocoris musculus* (Say), *Criocoris saliens* (Reut.), *Hyaliodes harti* Knight and *Haplothrips faurei* Hood. Reduction in numbers or elimination of predators was followed by an increase in numbers of both mites, and particularly of *M. ulmi*. The concentration of DDT used and the time at which it was applied determined the time and magnitude of the peaks of population attained by the mites, the delay in the re-establishment of predator populations, and the period elapsing until an equilibrium of low populations of predators and mites was again attained. Pre-blossom treatments, particularly at the lower concentrations, caused less disturbance than later treatments, and there was very little continuation of the effects into 1954. DDT had its greatest effects when applied immediately after the bloom period, and caused great destruction of predators and rapid increases to high peaks in number of mites; re-establishment of predators began late in the summer, and their attacks on the mite populations continued well into 1954. Late-summer applications apparently protected the mites from attack in the autumn, and large numbers of winter eggs were deposited. In consequence, populations reached high peaks during 1954, but began to decline in the later summer of that year as the predators became re-established. *Anthocoris*, which preys chiefly on mites and is rather tolerant of DDT, was the most prominent predator. None of the others showed any appreciable tolerance of DDT, although some escaped its effects by appearing on the trees too early or too late, and some, such as *Hyaliodes*, actually increased in numbers owing to the greater supply of prey that followed the destruction of other predators. *Haplothrips* was extremely susceptible to DDT applied at any time in the season.

MARTIN (J. L.). **The Bionomics of the Aspen Blotch Miner,** *Lithocolletis salicifoliella* **Cham. (Lepidoptera: Gracillariidae).**—*Canad. Ent.* **88** no. 4 pp. 155–168, 8 figs., 10 refs. Ottawa, 1956.

WATSON (W. Y.). **A Description of the immature Stages of** *Lithocolletis salicifoliella* **Cham. (Lepidoptera: Gracillariidae).**—*T. c.* pp. 168–177, 21 figs., 7 refs.

The first paper contains an account of field observations on the bionomics of *Lithocolletis salicifoliella* Chamb., the immature stages of which are described in detail in the second. This leaf-miner has long been known in the United States, where it attacks species of *Populus* and willow (*Salix*), was recorded on aspen (*Populus tremuloides*) in western Ontario in 1944 and had spread over the whole of that Province, as well as Manitoba, Saskatchewan and part of Quebec, by 1951. The outbreak began to decline in northern Ontario in 1952 and damage was negligible by 1954, when the observations were made. The larvae mine in the lower surfaces of the leaves and are often sufficiently numerous to cause premature browning. *P. tremuloides* was the preferred food-plant, but *P. balsamifera*, *P. grandidentata* and willows were also occasionally infested. The eggs were laid on the lower surfaces of the leaves between mid-May and mid-June and hatched in about 15 days. The larvae fed on the spongy parenchyma until early August, when they pupated in their mines. There were five larval instars, and a key for their separation, based on mine characteristics, is included. If two or more mines coalesced, only one of the larvae in them survived. The adults emerged in mid-August and overwintered, resuming activity when the foliage appeared in spring. Some evidence was obtained that overwintering takes place under the bark scales of coniferous trees, and that infestation is heavy only where these trees are also present. Parasite females were observed ovipositing in the mines during the latter part of June, and parasite adults emerged between the latter part of July and mid-August. Some nine species were represented, of which *Cirrospilus cinctithorax* (Gir.), which attacks the young larvae, was the most abundant; other common ones were an undescribed species of *Apanteles*, *Pnigalio tischeriae* (Ashm.), *Closterocerus* sp. near *C. trifasciatus* Westw., and *Alophosternum foliicola* Cushm. The resulting mortality was slight in the second larval instar but became increasingly heavy in the succeeding larval stages and the pupal stage. In 1954, larval competition and parasitism caused 53 and 36 per cent. mortality, respectively.

Davey (K. G.). **The Physiology of Dormancy in the Sweetclover Weevil.**—*Canad. J. Zool.* **34** no. 2 pp. 86–98, 5 graphs, 24 refs. Ottawa, 1956.

The following is virtually the author's summary. The physiology of the overwintering adults of *Sitona cylindricollis* Fhs. was investigated. It was found that the dormancy is characterised by a drop in oxygen consumption, a cessation of development in the reproductive organs, and a slight rise in fat content, and that the termination of dormancy is characterised by a reversal of these conditions. The water content does not change. Although the total respiration exhibited the characteristic U-shaped curve from entry into dormancy until its cessation, the CO-insensitive respiration remained at a low level throughout. Termination of the dormancy requires a period of exposure to low temperatures. It is concluded that this dormancy is not essentially different from diapause in immature insects.

House (H. L.) & Barlow (J. S.). **Nutritional Studies with *Pseudosarcophaga affinis* (Fall.), a Dipterous Parasite of the Spruce Budworm, *Choristoneura fumiferana* (Clem.). V. Effects of various Concentrations of the Amino Acid Mixture, Dextrose, Potassium Ion, the Salt Mixture, and Lard on Growth and Development; and a Substitute for Lard.**—*Canad. J. Zool.* **34** no. 3 pp. 182–189, 3 graphs, 7 refs. Ottawa, 1956.

The following is virtually the authors' summary of this fifth part of a series [*R.A.E.*, A **44** 160]. An improved chemically defined diet [*cf. loc. cit.*] has been developed for aseptic rearing of the Dipterous parasite, *Agria*

(*Pseudosarcophaga*) *affinis* (Fall.). The time required for 50 per cent. of the larvae to develop to the third instar was decreased from nine to five days, and the percentage of larvae that became adults was increased from 19 to 60. These improvements resulted from a reduction in the dextrose concentration to 0·5 per cent. of the diet and the inclusion of 0·4 per cent. of lard or of a mixture of fatty acids. Reducing the concentration of the salt mixture when the concentration of potassium was increased did not affect growth. The optimum concentration of amino acids was about 2 per cent. of the medium. Excessive concentrations of amino acids, dextrose and the salt mixture were toxic.

SALT (R. W.). **Influence of Moisture Content and Temperature on Cold-hardiness of hibernating Insects.**—*Canad. J. Zool.* **34** no. 4 pp. 283–294, 2 graphs, 6 refs. Ottawa, 1956.

In further investigations in Canada on cold-hardiness in insects [*cf. R.A.E.*, A **42** 404], the influence on it of desiccation and chilling was tested. Eggs of *Melanoplus bivittatus* (Say) and full-grown larvae of *Loxostege sticticalis* (L.), *Cephus cinctus* Nort., and its parasite, *Bracon cephi* (Gah.), all of which are overwintering, non-feeding stages, were used. In tests of the effect of desiccation, examples of the first three species were dried to various degrees, cooled till the undercooling point was reached, weighed, and dried at 95°C. to constant weight for determination of the moisture content. The effect of chilling was determined by exposing all four insects to constant temperatures of 0 or 5°C. [32 or 41°F.] or to natural conditions in the field during the overwintering season. The following is virtually the author's summary of the results. Moisture content affected cold-hardiness, measured as ability to undercool, only to the extent that it affected the concentration of body fluids and hence their freezing points. Undercooling remained approximately constant in amount over a wide range of moisture conditions. Only when desiccation was severe did it produce appreciable cold-hardening. Chilling at constant low temperatures was effective in increasing the cold-hardiness of *B. cephi*, ineffective in *M. bivittatus* and *C. cinctus*, and of doubtful effect in *L. sticticalis*. The variable temperatures of the natural environment produced significant cold-hardening in all four species; exposure to occasional periods of developmental temperatures are considered more likely to be responsible for this than is chilling. Blood density appeared to be related to cold-hardiness, but its ready response to other factors obscured the relationship.

BANKS (C. J.). **The Use of radioactive Tantalum in Studies of the Behaviour of small crawling Insects on Plants.**—*Brit. J. Anim. Behav.* **3** no. 4 pp. 158–159, 1 fig., 9 refs. London, 1955.

Radioisotopes emitting a high γ-radiation have proved useful for studying the behaviour of insects that live in soil or are not easily visible in dense vegetation [*cf. R.A.E.*, A **41** 374; **44** 238; **45** 187]. Radioactive tantalum (^{182}Ta) is suitable for external application, and the author describes a method by which it was applied to unfed newly-hatched Coccinellid larvae in order to study their behaviour on plants. Strips of tantalum 0·05 × 0·16 mm. in cross section were irradiated to the required specific activity, cut into lengths of 0·23 mm., giving a weight of about 0·03 mg., and mounted in glycerine on microscope slides. An apparatus in which the larvae were successively immobilised under a hair while a tantalum label was attached with a spot of adhesive was devised, as chilled insects recovered too quickly and the use of an anaesthetic was considered undesirable, and the method of using it is described. The adhesive was covered with water-colour paint to protect it while drying and to distinguish the labelled larvae by means of different colours. On larger larvae, cellulose paints were used as adhesives.

First-instar larvae of several species of Coccinellids moved actively, attacked Aphids readily and moulted normally when labelled with unactivated tantalum, but ceased feeding and died in 2–3 days or became malformed after partial moulting when radioactive labels with an average initial specific activity of 250 μc. per mg. were used. Newly laid eggs surrounding a label did not hatch, but larvae in later instars were apparently unaffected. Labels with a specific activity of 42 μc. per mg. had no noticeable effect on hatching or on larval growth or behaviour and proved satisfactory for study of the movements of Coccinellid larvae of all ages; marked insects in clumps of beans [*Vicia faba*] or on potato plants were readily detected from a distance of about a foot with a portable Geiger-Müller counter.

BANKS (C. J.). **The Behaviour of individual Coccinellid Larvae on Plants.**—*Brit. J. Anim. Behav.* **5** no. 1 pp. 12–24, 10 figs., 13 refs. London, 1957.

Since observations already noticed suggested that many of the larvae of predacious Coccinellids that hatch on bean plants (*Vicia faba*) might be unable to find Aphids on which to feed and would die of starvation [*cf. R.A.E.*, A **44** 186], investigations were made at Rothamsted on the movements of newly hatched larvae of *Adalia bipunctata* (L.), *Coccinella septempunctata* (L.) and *Propylea quatuordecimpunctata* (L.), which are common predators of *Aphis fabae* Scop. on beans. In field experiments, the larvae were labelled with radium sulphate in metal-foil disks or with radioactive tantalum [*cf.* preceding abstract]; in others, they were observed directly. The following is virtually the author's summary of the results. The larvae moved on bean leaves, as they did on a flat piece of paper, with frequent changes in direction, but the edges and prominent veins of leaves often determined the pattern of their tracks. The chance touching of leaves of adjacent plants influenced their direction of movement and, when Aphid colonies on bean plants were few, larvae might by chance be led far away from them. Coccinellid larvae wasted time and energy in repeatedly visiting parts of plants that they had already visited. Larvae that encountered Aphid colonies tended to stay near them, because after feeding they made small turning movements from side to side, which increased the chance of meeting another Aphid of a colony. This behaviour was different from the behaviour before feeding. An earlier conclusion that Coccinellid larvae are unable to perceive their prey from a distance was confirmed. Larvae (especially those in the first and second instars) took a comparatively long time to consume Aphids and, in the field, one of them was prevented from feeding on an Aphid colony by the attacks of attendant ants. The behaviour of the larvae is discussed in relation to their survival in the field, and it is considered likely that in areas of low prey density many larvae (especially newly hatched ones) die of starvation because they do not find Aphids.

VARTY (I. W.). *Adelges* **Insects of Silver Firs.**—*Bull. For. Comm.* no. 26, iv + 75 pp., 20 pls., 8 figs., 4 pp. refs. Edinburgh, H.M.S.O., 1956. Price 8*s*. 6*d*.

This bulletin, which replaces one previously noticed [*R.A.E.*, A **14** 340], contains a detailed account of observations in 1950–54 on the bionomics of

Chermes (*Adelges*) *nordmannianae* Eckstein (*nüsslini* Börner) and *C.* (*A.*) *piceae* Ratz. on silver fir (*Abies alba*) in north-eastern Scotland. The following is based on the author's summary of the results. The taxonomic position of these Aphids is discussed, the literature on their life-cycles, which are heterogeneous and very complex, is reviewed, and morphological descriptions are given of the various generations and instars. Preliminary observations on the value of paper chromatography as a taxonomic technique are recorded; it enabled the two species to be differentiated by the use of either eggs or adults.

Field and experimental studies showed the life-cycles of the two species to be similar to those recorded in other countries [*cf.* **35** 202, etc.]. The full cycle of five generations of *C. nordmannianae* in alternation on oriental spruce (*Picea orientalis*) as the primary food-plant, on which galls are formed, and *A. alba* as the secondary food-plant, was observed, the complete cycle lasting two years. *C. piceae* was restricted to *A. alba*, no sexuparae being produced in the field and consequently no migration to a primary food-plant occurring. This generation was reared in the greenhouse, however, and the main features of its development are described.

The effects of infestation by the two species on *A. alba* are discussed, and the finding of pathological "compression wood" [*cf.* **37** 247; **42** 263] in the stem of *A. grandis* attacked by *C. piceae* is recorded, this being the first mention of the phenomenon in any host tree in Britain. Investigation of the chemical effects of infestation of the leaves by *C. nordmannianae* showed that attacked shoots contained considerably increased amounts of leaf sugar, so that frost is not the cause of the browning and desiccation of infested leaves in spring. Analyses of nitrogen and mineral constituents of the leaves indicated the general debility of infested trees. Food-plant resistance to infestation was investigated, and the pH of resistant species of *Abies* was found to be lower than that of susceptible species, though further research is required before this association can be accepted as certain. The occurrence of outbreaks is also discussed. Those that have occurred in Scotland cannot be attributed to factors of the site unfavourable to *A. alba*. It is concluded that *C. piceae* is only of secondary importance on this tree in Scotland, whereas *C. nordmannianae* is a primary forest pest of wide distribution and persistence. Accordingly, the formation of stands of *A. alba* in Scotland is attended by considerable risk. Silvicultural methods of control, such as natural regeneration under an overwood or underplanting, are unreliable and chemical control requires repeated application. *A. grandis* or other species resistant to attack should therefore be planted where *A. alba* might seem silviculturally desirable, though experimental investigations with *A. alba* should continue.

Chamberlain (R.) & Willis (R. J.). **Observations on the Use of Benzene Hexachloride for the Control of certain Pests of Apple in Northern Ireland.**—*Res. exp. Rec. Minist. Agric. N. Ire.* **3** (1952–53) pp. 69–81, 7 refs. Belfast, 1955.

Willis (R. J.). **The Influence of the Apple Spray Programme on the Incidence of the Fruit Tree Red Spider Mite** (*Metatetranychus ulmi* **Koch) in Northern Ireland.**—*Op. cit.* **5** (1955) pp. 12–28, 14 graphs, 17 refs. 1957.

The following is largely based on the authors' introductions and summaries. As the ovicidal sprays formerly applied in winter to apple trees in Northern Ireland gave satisfactory control of mites and some Aphids and other pests, but not of *Hoplocampa testudinea* (Klug) and *Plesiocoris rugicollis* (Fall.), and DDT summer sprays, though highly effective against *P. rugicollis*, failed to control Aphids and mites, BHC was tested in 1951–53 in experiments described in the first of these papers. The results showed that suitable formulations of BHC could be used for the control of some of the commoner pests, a wettable-powder spray containing 0·2 per cent. BHC applied at the bud-burst and green-cluster stages controlling Aphids and *P. rugicollis* and one of 0·1 per cent. BHC at petal-fall controlling *H. testudinea.* On a commercial scale, such treatments are cheaper than the alternative measures formerly used. Wettable BHC is compatible with the mercury-based fungicides used against apple scab [*Venturia inaequalis*] and can be combined with bordeaux mixture, provided that the spray is applied soon after preparation.

The second paper comprises an account of investigations on the influence of various spray programmes on the incidence of *Metatetranychus ulmi* (Koch), and it is shown that whereas the inclusion of 0·05 per cent. DDT at the green-cluster stage results in a marked increase in mite populations, a comparable application of 0·2 per cent. BHC at the green-cluster and pink-bud stages reduces them for the whole summer; a petal-fall application of 0·2 per cent. BHC has less effect and may be followed by a general, though not excessive, increase in mite populations in late summer. Replacing bordeaux mixture by mercury-based fungicides had no marked effect on *M. ulmi*, but the substitution of captan [N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide] for mercury compounds in a spray programme that included pre-blossom and post-blossom applications of 0·2 per cent. BHC resulted in the development of much higher populations. Field tests with a series of summer ovicides showed that treatment with 0·025 per cent. p-chlorophenyl p-chlorobenzenesulphonate or 0·02 per cent. p-chlorobenzyl p-chlorophenyl sulphide in early June and again in mid-July gives good control. The results support the view that the climate of Northern Ireland is unfavourable for *M. ulmi*.

Büttiker (W. W. G.). **The entomophagous Behaviour of** *Pseudospilophorus plagosus* **Boh. (Cetoniidae, Coleopt.).**—*Acta trop.* **12** no. 4 pp. 346–347, 1 fig., 3 refs. Basle, 1955.

Adults of *Pseudospilophorus plagosus* (Boh.) were observed preying on *Coccus hesperidum* L. in a young *Citrus* orchard in South Africa, in which they were present from October 1953 to March 1954. They were most abundant in November, when as many as 27 occurred on one orange tree, and they were confined to branches infested by the Coccid. The Cetoniid refused to feed on *Aonidiella aurantii* (Mask.) or vegetable matter in the laboratory, but a single female consumed about 30 adults and nymphs of *C. hesperidum* in 24 hours. Nevertheless, it was not able to control the Coccid in the field. No other predacious Cetoniids are known.

Bünzli (G. H.) & Büttiker (W. W.). **Curculionid Pests of Tobacco in Southern Rhodesia.**—*Acta trop.* **12** no. 4 pp. 348–355, 2 figs., 1 ref. Basle, 1955.

Weevils of the genera *Mimaulus*, *Protostrophus* and *Analeurops* cause local injury to young tobacco crops in Southern Rhodesia each year, but the damage was unusually severe in 1951–52. The species concerned were *M. thesii* Mshl., which was the most widely distributed and was most numerous south of Salisbury, where it usually occurred alone, *P. platyops* Mshl., and *A. cuthbertsoni* Mshl. [*cf. R.A.E.*, A **26** 106; **30** 48], which was confined to seed beds. As a result of feeding by the weevils, small holes appear in the lower leaves, their edges become jagged, and the stem is occasionally eaten through; when several weevils occur on one plant, all the aerial parts are ultimately consumed. Weeds and dry plant material are also eaten. Populations of 20,000 per acre suffice to cause economic damage, but those present in 1951–52 reached up to three times this number, so that the plants were destroyed within 1–3 weeks of transplanting. The adults appeared above ground at the end of October or the beginning of November with the onset of the rains, and survived for 2½–5½ months; among field-collected individuals, mortality reached 7·5 per cent. in February and 50 or even 100 per cent. by March. The weevils shelter under the leaves or in the soil during the cooler parts of the day, and pairing was observed in the soil at a depth of 5 cm. Two eggs laid in the laboratory in December by field-collected females hatched within ten days, but the larvae did not survive. The natural habitat of the weevils is open veldt on sandy soils with pH values of 6–7·6 on which grasses predominate but where a fair proportion of low-growing sedges and leguminous plants also occur, and lists of the associated plants and insects are given. Infestation is virtually confined to fields in the first year of cultivation or that have lain fallow for several years, but it is also liable to occur in established fields in which tobacco follows a leguminous crop and clean cultivation is not practised.

Measures of value in preventing infestation comprise repeated hoeing when damage first appears, ploughing the fields in November–December and keeping them under bare fallow till planting time, and thorough burning in November followed by ploughing for planting in December; burning the veldt during winter is probably of only limited value against the larvae in the soil. The permanent habitat is best destroyed by burning combined with drainage. Where cultural measures cannot be applied, vigorous seedlings with well hardened stems should be used for planting and especially for replacements, and deep planting should be avoided. Details are given of field tests with various insecticides applied in liquids or dusts against the adults of *M. thesii*, in which an emulsion containing 0·1 per cent. chlordane applied at 100 cc. per plant station before or after planting enabled over 90 per cent. of the plants to become established under conditions of heavy infestation and even on previously uncultivated land that was treated six days after planting. The liquid should be applied to as large an area as possible round each plant station.

APPERT (J.). **La bruche des arachides.**—*Bull. agron. Sect. tech. Agric. trop.* no. 13 (*Ann. Cent. Rech. agron. Bambey 1954*) pp. 181–190, 11 refs. Nogent-sur-Marne, 1956.

Groundnuts stored in West Africa are infested by a Bruchid of the genus *Caryedon* that has been known as *C. fuscus* (Goeze) in British territories [*cf. R.A.E.*, A **40** 200; **44** 5, 450; **45** 121] and as *Pachymerus cassiae* (Gylh.) in French ones [*cf.* **25** 96; **44** 342]. The author states that the use of the latter name for it is probably due to misidentification. He briefly describes all stages of the Bruchid and gives an account of investigations in 1953–54 on its bionomics and control in Senegal, where groundnuts are stored in the pod from December to June in conical mounds in the open, or more rarely in sheds with sheet-metal walls, and it is the most important of the pests attacking them. The females oviposit on the pods, and the larvae hatch 8–15 days later, enter the pods and feed on the seeds, which they sometimes destroy almost completely. When full-fed, the larva cuts a circular hole to the exterior and pupates in a cocoon either in the pod, close to the hole, or outside, between two pods. There may be up to six generations a year, each lasting about two months, and damage becomes severe by the time of the third, when the groundnuts have been stored for six months. The larvae are able to survive in their cocoons for long periods, and infestation is thus carried over from one crop to the next. The adults are nocturnal; they are favoured by temperatures of 25–32°C. [77–89·6°F.], die rapidly at 40°C. [104°F.] and require a relative humidity of at least 20 per cent.

In laboratory tests, pairing occurred soon after emergence, and oviposition took place about 36–48 hours later, 80 per cent. of the total numbers of eggs being laid 2–4 days after the beginning of oviposition. Groundnuts were preferred to tamarind pods. The percentages of eggs that gave rise to adults were 40 and 39 when the groundnuts bore 9 and 10 eggs each, respectively, and 53·5–70 when they bore 1–8, and a maximum of 8–9 examples completed their development per pod. In tests on fecundity, hatching and the length of the life-cycle, batches of 50 pairs were kept at temperatures of 27, 30, 33 or 36°C. [80·6, 86, 91·4 or 96·8°F.] and relative humidities of 20, 50, 70 or 90 per cent. The numbers of eggs laid per 50 females were highest (1,093 and 1,056) at 27°C. and 50 and 70 per cent. relative humidity, and decreased as the temperature was raised and the relative humidity raised or lowered, the decreases being sharp when the temperature was 36°C. and when the relative humidity was 20 per cent. No eggs hatched at 20 per cent. relative humidity, and less than 10 per cent. did so at 90 per cent., whereas 54·1–57·3 and 61·1–69·4 per cent. hatched at 27–33°C. and 50 and 70 per cent. relative humidity, respectively. The minimum duration of development from egg to adult became shorter with increased temperatures, lasting only 41 days at 33°C. and 90 per cent. relative humidity, but the Bruchid does not multiply very rapidly at this humidity in winter as hatching is reduced. The temperature in large masses of stored groundnuts increases as a result of fermentation, which accelerates the development of the Bruchid, and sometimes permits the appearance of an extra generation, resulting in total loss of the produce.

Control measures are reviewed from the literature [*R.A.E.*, A **24** 239]. In tests, various powders were mixed with undecorticated groundnuts in jars, adults were added, and the jars were kept at 26–30°C. [78·8–86°F.] and 60–90 per cent. relative humidity. The dusts tested comprised 5 and 10 per cent. DDT, 8 and 25 per cent. BHC, 0·6 per cent. lindane [almost pure γ BHC], 7 per cent. T.T.C. [polychlorocyclohexane trithiocarbonate], 0·8 per cent. parathion (SNP), 2·5 per cent. aldrin and 2·5 per cent. dieldrin. They all gave complete kill in six days when used at 0·5 per cent., but the γ BHC and dieldrin powders were the only ones to do so at 0·1 per cent., though 25 per cent. BHC gave 98 and parathion 99 per cent. mortality; the most effective at 0·05 per cent. were γ BHC and parathion, which gave 85 and 88 per cent. kill. When ovipositing females were added to groundnuts that had been treated with the various powders at 0·25 per cent. 15–150 days previously, parathion and 10 per cent. DDT were the only ones to give complete kill in 48 hours 90 days after treatment, and parathion, γ BHC and dieldrin gave 88, 79 and 73 per cent. mortality, respectively, after 150 days. Suggestions are made for improving the technique of applying the powders in practice, and the advantages and disadvantages of storage in the open or in sheds are discussed. It is suggested that a shed with perforated metal sides would combine the advantages of both methods.

CASTEL-BRANCO (A. J. F.). **Some Remarks about** *Diparopsis castanea* **in Mozambique.**—*Garcia de Orta* **3** no. 2 pp. 225–230. Lisbon, 1955.

Diparopsis castanea Hmps. is a serious pest of cotton in Portuguese East Africa, where it has been estimated to destroy about 32 per cent. of the potential crop. All stages of this Noctuid are described, and the results are given of observations in the field and laboratory on its bionomics.

There were three generations a year, emerging mainly in March, May and December–January, respectively, and part of the last two generations survived from one crop to the next. Few adults were present after July. Pairing occurred during flight and did not take place in the laboratory. Only fertilised females oviposited, but those kept in captivity rarely laid more than 100 eggs each, though unfertilised ones contained about 450. The eggs were laid singly on the plants, in the evening, and all hatched. The egg stage is stated to have lasted six days whether the eggs were incubated in the open, or in the laboratory at 4°C. [39·2°F.] or 35°C. [95°F.]; their age can be estimated by colour and other changes that are described. The newly hatched larvae were agile and rejected all food except germinating cotton seeds and leaf or flower buds. They died in 24 hours if food was not available. Attacked buds dried up. In the second and third instars, the larvae fed in young bolls, in which they attacked the developing seeds, later migrating to others. The fourth- and fifth-instar larvae attacked older bolls. The larvae are said to feed on the stalks, in the absence of buds and bolls. The larval stage lasted nearly a month, and the prepupae fell to the ground and entered the soil to pupate. Pupal cells were formed in damp soil, but not in dry loose soil, and high temperatures and lack of shade were unfavourable for survival of the prepupae. The duration of the pupal stage was found to vary with the temperature at which the eggs were incubated. Eggs incubated at temperatures ranging between 4 and 14°C. [57·2°F.] gave rise to long-cycle pupae, whereas eggs from the same parents incubated at atmospheric temperature (about 28°C. [82·4°F.]) gave rise to short-cycle pupae. The usual duration of the pupal stage was 20–30 days. The adults emerged in the morning and were ready to fly by nightfall. During the day they are immobile.

No natural enemies of the eggs were observed. The larvae were destroyed by birds and lizards, and 13·5 per cent. of the pupae were attacked by an unidentified species of Hymenoptera. The adults were destroyed by birds and also by small ants, which fed on the abdomens of both sexes without arousing resistance. Spraying in March 1953 with an emulsion concentrate containing 25 per cent. parathion diluted to 0·25 per cent. about doubled the yield.

CANNING (E. U.). **A new Eugregarine of Locusts,** *Gregarina garnhami* **n. sp., parasitic in** *Schistocerca gregaria* **Forsk.**—*J. Protozool.* **3** pp. 50–62, 39 figs., 27 refs. Utica, N.Y., 1956.

The following is based almost entirely on the author's summary. The structure and life-history of a new species of *Gregarina*, here designated *G. garnhami*, sp. n., are described from material found in the intestinal caeca and mid-gut of nymphs and adults of *Schistocerca gregaria* (Forsk.) obtained from the Anti-Locust Research Centre, London. The parasite, which was also found in four living examples of *S. gregaria* from Egypt, destroys considerable areas of the caecal epithelium and, in cases of heavy infestation, the masses of parasites present in the mid-gut result in the formation of localised barriers between the gut wall and the food material in the lumen. The cephalont and sporont stages of gregarines from *Locusta migratoria migratorioides* (R. & F.), also from the Anti-Locust Research Centre, and *Anacridium aegyptium* (L.) from Egypt were found to be similar to those from *S. gregaria* and are believed to belong to the same species.

ELLIS (P. E.) & ASHALL (C.). **Field Studies on diurnal Behaviour, Movement and Aggregation in the Desert Locust** (*Schistocerca gregaria* **Forskål**).—*Anti-Locust Bull.* no. 25, [4+] 94 pp., 8 pls., 28 figs., 46 refs. London, 1957.

The following is based on the authors' summary of this detailed account of observations carried out during 1949–56, mostly in Ethiopia and Kenya, but also in neighbouring territories. Observations in the *Commiphora-Acacia* bush of Ethiopia and northern Kenya, where minimum air temperatures were above 17°C. [62·6°F.], showed that bands of hoppers of *Schistocerca gregaria* (Forsk.) had a definite diurnal pattern of behaviour, although at no time were all the individuals in a band engaged in the same activity. Before dawn, the hoppers were mainly roosting. About a quarter of an hour before sunrise, they streamed down from the vegetation and marched in dense columns on the ground in much the same direction as on the previous day. This pre-dawn marching began at the same time in various parts of the band and never lasted for more than 2½ hours. Once the sun was sufficiently high to warm the surface of the sand, the hoppers collected into dense groups, generally in the sun. In large bands, the period spent in ground groups was far shorter at the front and rear of the band than at the centre. After ¼–2 hours, the hoppers resumed marching, hopping instead of walking as the day became warmer. During the hottest part of the day, most of them roosted, but a few marchers were generally present. In the afternoon, marching was resumed and continued until near sunset, when groups were formed round the base of conspicuous bushes and plant masses. These groups were variable in their frequency and the time at which they were formed (which varied from 1½ hours before sunset to 2½ hours after it) and always appeared first at the front of bands, where the hoppers were densest. Evening ground grouping was followed by roosting or further marching, which usually died out 3–9½ hours after sunset.

During the first two days after hatching, hoppers often did not march, but roosted or rested in the shade. There was less activity in small bands than in larger ones and activity also decreased before a moult; in both these cases, pre-dawn and night marching often did not occur. In small bands, there were continuous cycles of activity during the marching periods, comprising feeding, resting and marching and each lasting 15–45 minutes. They probably occurred in large bands also, but were less easily identified because the hoppers were not all in the same stage of the cycle at the same time. Feeding occurred at all times of the day and night. In cage tests, the amount eaten generally reached a maximum between two hours before and two hours after sunset and a minimum between six hours before and one hour after sunrise. Sometimes there was a small mid-morning peak. The number of faecal pellets and the weight of the excreta proved poor indicators of feeding activity.

Each behaviour pattern was influenced by several environmental factors, and the main conclusions reached in laboratory studies of *Locusta migratoria migratorioides* (R. & F.) [*R.A.E.*, A **39** 189; **44** 152] were confirmed for *S. gregaria* in the field. Marching was favoured by air temperatures of 17–36°C. [96·8°F.]; above and below these limits, hoppers roosted. Marching was reduced at air temperatures above 30°C. [86°F.] when the sun was overhead and below 28°C. [82·4°F.] in moonlight or darkness; it ceased at 24°C. [75·2°F.]. Evidence suggested that the temperature limits for the various activities could be modified by conditioning. In the morning, ground grouping was favoured by air temperatures between 22·5°C. [72·5°F.] and 28°C. and in the evening by temperatures of 25·5–33·5°C. [77·9–92·3°F.]. Hypotheses, based on earlier work [**27** 603; **44** 463–464], are put forward to explain the inactivity associated with ground grouping. The morning descent and pre-dawn marching appeared to be stimulated by increasing light intensity. Once it was begun, marching was maintained by hopper interactions. The diurnal pattern of behaviour is possibly altered when night temperatures are too low for locomotion.

Small bands of 10,000–20,000 hoppers, with night-roosting areas of about 20–40 and 250–500 sq. yards in the first and fifth instar, respectively, moved about two miles during hopper life, and large ones, with night-roosting areas of 10,000–15,000 sq. yards and containing 5–9 million first-, 2–4 million third-, or 400,000–680,000 fifth-instar hoppers, moved about 12 miles, the greater distance covered being presumably due to more numerous hopper interactions. Distances travelled were reduced prior to moulting. There was less total movement in luxuriant than in sparse vegetation, which offered little mechanical obstruction, provided fewer opportunities for feeding, and allowed the hoppers a better view of one another. On the whole, hoppers marched further on bright sunny days than on cool, cloudy ones. Accidental disturbance by predators or domestic animals caused bands to become practically stationary, the disturbed hoppers taking refuge in bushes. Small bands moved fairly consistently with the wind. Larger ones marched at all orientations to the wind, but since the hoppers tended to fan out on the downwind side, they still showed reactions to it. During the first two days after hatching, the directions of movement continually changed, but older hoppers tended to march in the same direction day after day. Small clear spaces, such as roads, canalised movement, but hoppers turned back if they came to an open or very sparsely covered area, and the changes in direction involved were often large. The new direction tended to be maintained by gregarious inertia [*cf.* **34** 352]. There seemed no necessity to postulate orientations to the sun, although a telotaxis or a thermo-reaction may help the scattered hoppers at the rear of bands to maintain course when out of visual contact with others. Although whole bands maintained a steady direction, the various hopper streams within a band marched in different directions as the individuals went round plants and other obstructions.

The degree to which hoppers aggregated varied during the life-history and was at all times the result of a combination of their reactions to one another and to the patchy nature of the physical environment. Egg pods were generally laid in small groups of less than 20, frequently at night. The relationship of the vegetation to bare patches of soil played some part in the grouping. If soil texture or moisture varied greatly from place to place, further concentration occurred. It was, however, difficult to explain the grouping entirely by reactions to the physical environment. At all times, ovipositing females showed some positive reactions to one another. When pod densities were 0·13 per sq. ft. or less, the hatchling groups joined during the first two days of life to form numerous separate bands of up to 30,000 hoppers. At pod densities above 0·25 per sq. ft., the groups of hatchlings were close enough to form one large band. Bands tended to split into smaller units at moults because of slight variations in the individual rates of development; hoppers nearest the moult ceased marching first. Although a band may leave groups of hoppers behind, isolated individuals were rarely found. Predacious birds tend to feed on scattered hoppers at the rear of bands, and these rapidly disappear in consequence. Further splitting took place during fledging, so that the young adults from a population of hopper bands became spread out, as small groups, over a very wide area. During any one day, the area covered by a band increased until midday and then decreased again towards sunset. The area covered at midday was two to four times that at night. Contraction took place mainly at the time of the formation of the evening ground groups, the more scattered hoppers at the rear of the band marching until they came to a large group. Luxuriant but uneven vegetation, with bare patches of ground, favoured dense aggregations. Dispersal occurred in even stands of vegetation with no bare patches of soil between plants, provided that the number of hoppers in relation to the area was small. It was concluded that such habitats hindered hopper interactions. Hot, dry weather, coupled with a sparse and fairly evenly distributed plant cover, also caused the dispersal of hoppers that hatched from large dense groups of egg pods; in these circumstances, dispersal was due to reduction in numbers resulting from cannibalism, starvation and excessive loss of body water, to a reduction in degree of social aggregation at high temperatures and to the sparseness and wide spacing of suitable places for roosting. In solitary adults, there was evidence of aggregation in relation to plant species.

The importance of behaviour in relation to outbreaks is discussed. Evidence is given of the aggregation and breeding of solitary locusts in association with relatively plentiful rainfall, and of increased gregarisation resulting from rains that extended the area of luxuriant plant growth to places where the vegetation cover was naturally patchy.

Rainey (R. C.), Waloff (Z.) & Burnett (G. F.). **The Behaviour of the Red Locust (*Nomadacris septemfasciata* Serville) in Relation to the Topography, Meteorology and Vegetation of the Rukwa Rift Valley, Tanganyika.**—*Anti-Locust Bull.* no. 26, [4+] 96 pp., 6 pls. (1 fldg.), 13 figs., 8 pp. refs. London, 1957.

The following is virtually the authors' summary. Observations on immature adults of *Nomadacris septemfasciata* (Serv.) and on associated meteorological factors were made at a number of localities in the Rukwa Valley outbreak area, Tanganyika, in May–July 1948, during the early part of the dry season. Most of the observations related to concentrations of locusts in stands of grass 6–8 ft. high; such grass was found to have marked effects on the régime of wind, temperature and, at times, humidity to which the locusts were subjected.

On most days, observed spontaneous flight was restricted to short flights during the morning descent from, and the evening ascent into, the grass-tops; concerted spontaneous flight on an appreciable scale was seen only on two brief occasions, both in the late afternoon. On general behaviour, and on morphometric criteria derived from a re-examination of all available morphometric data for samples of locusts of adequately recorded behaviour, the 1948 populations could be referred to phase *transiens*. Samples from Katisunga, moreover, exhibited the significantly higher variance of morphometric characters which appears to characterise populations for which evidence of congregation or dissociation is available. The measurement of samples also demonstrated the existence, in different parts of the valley during May–July 1948, of at least four morphometrically distinct locust populations, between which interchange of individuals, during the three preceding months of adult life, can only have occurred on a very small scale, if at all. Similarly, morphometrically distinct populations were also present in the North and Central Rukwa plains in both of the earlier years for which published data are available [*R.A.E.*, A **27** 387; **37** 135], and are also likely to have remained distinct throughout at least the greater part of adult life. Evidence of the validity of such morphometric characterisation of populations was provided by the degree of agreement between two independent large samples of one population taken at points three miles apart and with an interval of 11 days, and between two other samples taken at an interval of five months from a single population observed from time to time throughout this period. This latter population was observed to move a net distance of no more than a mile between June and December, which illustrates the effectively static behaviour of the locusts studied, and is consistent with the manner in which the various populations remained distinct. The stationary nature of these populations was attributable partly to the comparative rarity of flight, and partly to the restricted extent of the resulting displacement even in relation to the amount of flying done, directing attention in the first place to limiting conditions for flight, and in the second place to the factors that influence the displacement of airborne locusts, namely, winds (vertical as well as horizontal), flying speed, and orientation.

Determinations of internal body temperature were made on representative series of locusts for which behaviour had been individually recorded prior to capture, and thermal balance sheets were computed for typical settled and flying locusts. From about two hours after sunrise until an hour or so before sunset, all body temperatures recorded were within the range found necessary for sustained flight; following disturbance by grass fires, sustained flight by large numbers of locusts was, in fact, occasionally seen during the middle of the day. It is accordingly unlikely that the relative rarity of flight at this time of day was attributable to any simple physical limiting factor. Detailed observations on the diurnal régime of behaviour of these populations indicated that the most important factor limiting flight activity during the middle of the day may have been lack of mutual stimulation, possibly attributable partly to the relatively small size of the locust populations concerned in this season, and partly to a general restriction of mutual perception within the typical thick grass habitats of the Rukwa. Observations on flying locusts from these populations indicated an average airspeed of about 11·2 miles an hour at air temperatures of 26–32°C. [78·8–89·6°F.]. The locusts seen in flight were recorded either as heading in a generally up-wind direction, or as apparently circling, in both cases remaining in the vicinity of the point of take-off; both forms of behaviour, possibly involving visual attraction to particular features of the locality concerned, are likely to have contributed to the striking lack of effective displacement exhibited by such populations, despite flight in winds predominantly from a single quarter.

Observations of the air-flow over the Ufipa escarpment, which flanks the valley on the south-west, demonstrated, under conditions likely to have been representative of much of the dry season, a well-marked, local, diurnal wind-variation, with an up-slope component during most of the day and a down-slope component by night; this was associated with the differing diurnal temperature régimes of the escarpment, the valley floor, and the free air above it, and was superimposed on a general easterly or south-easterly air-flow over the whole area. Furthermore, this regular deflection of the air-flow near the ground, towards and up the escarpment by day, was associated with up-currents strong enough to enable even gliding locusts to gain height without muscular effort. It is, however, probably only in relatively exceptional circumstances that flying locusts in numbers actually enter this circulation, and they may spend several months within a few miles of the escarpment before doing so.

While the weather and vegetation of the Rukwa have enabled *Nomadacris* to breed within the valley in every year so far recorded, and on a very large scale in some years, the grass stands of the Rukwa plains provide a series of successive habitats within which very large populations may live for long periods under what are suggested as conditions of minimal mutual stimulation. It is further suggested that outbreak areas such as the Rukwa Valley may be characterised, not by factors specifically favouring the full development of swarm behaviour, but by these extensive habitats in which typical swarm behaviour is markedly inhibited by the reduction of mutual stimulation. Such inhibition of the full flight behaviour typical of swarms may be a factor in the retention and accumulation of large populations within such areas. The escape of swarms on a serious scale may thus require not only the production of very large numbers of locusts, but also a measure of release from the inhibiting effects apparently characteristic of these grassland habitats.

Chapman (R. F.). **Observations on the Feeding of Adults of the Red Locust (*Nomadacris septemfasciata* (Serville)).**—*Brit. J. Anim. Behav.* **5** no. 2 pp. 60–75, 14 graphs, 11 refs. London, 1957.

The following is virtually the author's summary. A study was made of the feeding behaviour of *Nomadacris septemfasciata* (Serv.) in the Rukwa Valley, Tanganyika. The amount of food in the oesophagus was used as an indication of feeding. It was found that the rate at which the oesophagus emptied varied with temperature. In March, October and November, feeding occurred in morning and evening peaks and was reduced in the middle of the day. From April, when it continued all day, it steadily declined, and reached a minimum in September. Analysis showed that feeding was greatest between 26 and 34°C. [78·8 and 93·2°F.], but the exact limits varied according to the temperature conditioning of the locusts, being higher when they were conditioned to high temperatures and lower when they were conditioned to low ones. This applied both during the course of a day and from season to season. There was no evidence of feeding at night. It was concluded that the seasonal variation in feeding must be attributed to physiological changes within the locusts, as must a marked increase in feeding in females as compared with males that occurs in December; only at the time when the eggs were developing were marked differences between males and females in this respect observed. A rough key was constructed to enable the crop contents of locusts to be identified. The species and condition of the food eaten depended not only on the choice available but also on the displacements of the locusts relative to the food. Short grasses were mostly eaten except in March and April, when food was also available in the roosts. Of 4,555 locusts examined, 95 per cent. had fed on grass leaves. In food preference experiments, *Echinochloa*, *Cynodon* and *Cyperus* were the most acceptable grasses. Analysis suggested that these were the grasses with softest leaves and highest moisture content. Mortality experiments suggested that the survival rate was highest on *Echinochloa*. The number of locusts that fed depended on the grass present even in the absence of choice. More fed on the soft, moist grasses than on the drier, harder ones. Thus, far more fed on *Echinochloa* than on other grasses. This was true even after long periods of starvation. An indication was obtained that the locusts differentiated similarly in the field. Marking and recovery experiments suggested that activity was related to the vegetation present in the habitat. Locusts marked in *Sporobolus* moved farther in a shorter time than those marked in *Echinochloa*. The distribution of the locusts was associated with the vegetation, and concentration into zones of *Echinochloa* was an active, directed movement. *Echinochloa* is an important factor in the behaviour of *N. septemfasciata* in the field. The evidence brought forward indicates that its importance may be associated with its value as food as well as its physical properties.

Pradhan (S.) & Bindra (O. S.). **Studies on Resistance to contact Toxicity of Gamma-BHC Suspensions by successive Instars of** *Schistocerca gregaria* **Forsk. and certain associated Factors.**—*Indian J. Ent.* **18** pt. 2 pp. 93–111, 3 graphs, 28 refs. New Delhi, 1956.

The results are given of investigations in which laboratory-reared hoppers of both sexes of *Schistocerca gregaria* (Forsk.) in phase *gregaria* were sprayed with suspensions of almost pure γ BHC three days after hatching or moulting, removed to untreated food, and examined for mortality daily until there was no further increase. Concentration-mortality curves were plotted from the results, and the median lethal concentrations were calculated. It was found that these were about doubled for each successive instar from the first to the fifth, and further investigations indicated that effectiveness varied directly with the surface area per unit body weight and the percentage of wax in the exuviae and inversely with the thickness or compactness of the cuticle. After allowances for these three factors had been made, the inherent protoplasmic resistance appeared to be higher in the first than in the later instars.

Seshadri (A. R.). **An Outbreak of the Migratory Locust** (*Locusta migratoria* **Linn.**) **in Ramanathapuram District (Madras) in 1954.**—*Indian J. Ent.* **18** pt. 2 pp. 112–122, 2 figs., 1 map, 3 refs. New Delhi, 1956.

Mukerji (S.) & Chatterjee (S. N.). **An additional Phase Character in Specimens of** *Locusta migratoria* **Linnaeus collected from South India.** —*T. c.* pp. 161–164, 2 figs., 3 refs.

In the first of these papers, a detailed account is given of an outbreak of *Locusta migratoria* (L.) that occurred in the Aruppukkottai Taluk of the Ramanathapuram District of Madras State in February–March 1954, the first in southern India since 1878. This locust is constantly present in the solitary phase in the south of the country and multiplies rapidly under favourable conditions. Hoppers were first seen on 12th February, but had probably been present since the third week of January, and hopper bands and swarms of adults were common from 25th February, but all had crossed the northern boundary by the third week of March. Oviposition had probably begun by mid-January. Rainfall had been fairly heavy in October and November 1953 and in mid-January 1954, providing favourable conditions for breeding, and the swarms were large and dense. An area of some 200 square miles was affected, but the hoppers appeared to prefer sandy areas and caused little damage to crops, feeding almost entirely on grasses and weeds. Control was carried out mainly by mechanical means, but a 10 per cent. BHC dust was used successfully in two localities. No further swarms were observed in any area of Madras up to August 1955.

In the second paper, the authors report that three adults of *L. migratoria* collected during the outbreak differed greatly from specimens of phase *solitaria* in the Pusa collection; determination of the E/F ratios [*cf. R.A.E.*, A **27** 560] showed that two were of phase *transiens* and one of phase *gregaria*, whereas the F/C ratios [**43** 336] indicated that all three were of phase *gregaria*. Comparison with 85 specimens of phase *solitaria* in the collection showed that all these had a row of well-developed pointed denticles accompanied by setae on the dorsal ridge of the hind femur, whereas the three from southern India had none, the femora presenting smooth surfaces. Examination of specimens of the African migratory locust, *L. m. migratorioides* (R. & F.), in phase *transiens* or *gregaria* showed much reduction in the size of the denticles though not an absence of them. It is tentatively concluded that the relative development of denticles on the dorsal edge of the hind femur may prove to be an additional morphological phase character in *L. migratoria*.

Sen (A. C.) & Prasad (D.). **Biology and Control of the Mango Mealy-bug** (*Drosicha mangiferae* **Green**).—*Indian J. Ent.* **18** pt. 2 pp. 127–140, 9 refs. New Delhi, 1956.

Some of the information in this detailed account of observations on the bionomics of *Drosicha stebbingi* (Green) (*mangiferae* (Green)) on mango in Bihar and experiments on its control in 1951–55 has already been noticed [*cf. R.A.E.*, A **45** 69]. The eggs of this mealybug are deposited in the soil in May and hatch usually between mid-December and the end of January, though they may do so earlier when the rainfall of the previous monsoon has been light; nymphs are present in the first, second and third instars until early February, mid-March and late April, respectively, adult males emerge in April, and adult females appear towards the end of April and the beginning of May.

When applied to the soil round heavily infested trees at 8 oz. per tree in May, after preliminary raking, 10 per cent. toxaphene dust caused less than 25 per cent. mortality of eggs, and dusts containing 10 per cent. BHC, 2·5 per cent. chlordane or 10 per cent. DDT, and a proprietary parathion powder (Folidol E-605) were ineffective. In tests of the proprietary adhesive that had proved effective in preventing the nymphs from ascending the trunks [*cf. loc. cit.*], bands 1, 2, 3 and 4 ins. wide remained effective for averages of 69, 59, 72 and 73 days, respectively. When applied to the trunk in a band 6 ins. wide about a foot above soil level, at the time of hatching and 3–4 times later in the season, the parathion powder killed more nymphs and resulted in lower populations by the end of the active season than 5 per cent. DDT or 10 per cent. BHC, and 10 per cent. toxaphene and 5 per cent. chlordane were slightly less effective. In small-scale tests of various concentrations of insecticide against the nymphs, parathion was very effective against those in the first two instars, but relatively ineffective against those in the third. A proprietary pyrethrum preparation, BHC and chlordane proved somewhat less toxic in each case.

In a large-scale test to compare banding the trunks with the proprietary adhesive in the last week of December and dusting them with 10 per cent. DDT three times, beginning on the same date, the two treatments reduced the average number of nymphs per shoot at the end of May from 1·5 to 0·02 and 0·17, respectively. Banding was cheaper than dusting, but some nymphs survived in the banded orchard by feeding on low vegetation, so that treatment for three successive years was necessary to eradicate the pest, whereas the few that survived the DDT treatment were unable to reproduce and the infestation was eradicated by further treatment in the following year.

Khot (K. N. S.) & Patel (G. A.). **Life-history of the** *Gladiolus* **Mite—** *Tetranychus equatorius* **McGr.**—*Indian J. Ent.* **18** pt. 2 pp. 149–160, 2 figs., 3 refs. New Delhi, 1956.

A species of *Tetranychus* cited as *T. equatorius* McG., which the authors consider not to be a synonym of *T. cucurbitae* Rahm. & Sapra [*cf. R.A.E.*, A **44** 19], is common in the Poona area of Bombay and has recently caused serious losses of *Gladiolus*. The mites feed on both leaf surfaces and, if numerous, cause the leaves and even whole plants to dry up. The authors describe all stages, quote the original descriptions of the adults, and give a list of 38 plants on which the mite was observed and a short account of its bionomics [*cf.* **35** 31]. In cage tests, the egg, larval, protonymphal and deutonymphal stages lasted 3–9, 3–5, 3–4 and 2–5 days, respectively, and the preoviposition and postoviposition periods 1–2 and 1–3 days. Adult males and females lived for 8–12 and 6–28 days, the females deposited 24–55 eggs each and the eggs laid by unfertilised individuals generally gave rise to males.

PRASAD (A. R.) & HAQUE (M. W.). **Preliminary Laboratory Investigations with Systox on Sugarcane.**—*Indian J. Ent.* **18** pt. 2 pp. 190–193, 3 refs. New Delhi, 1956.

In tests carried out in Pusa on the control of *Pyrilla perpusilla* (Wlk.) on sugar-cane, emulsifiable Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] was applied at 0·25 and 0·5 per cent. in sprays to the leaves or in the irrigation water to the roots of plants grown in pots, and adults were subsequently caged on the leaves. All treatments proved very effective. The root treatments remained so for 10 and 20 days, respectively, the insects surviving for averages of 17·8–28·4 and 15·2–18·7 hours, and the spray treatments for six days, the insects surviving for averages of 7·6–8·4 and 2·2–2·6 hours, respectively, at the two concentrations. The percentage mortality declined with lapse of time after treatment, probably owing to decomposition of the compound, the highest being recorded within 24 hours. No toxic effect on the plants was observed.

SUBRAMANIAN (T. R.). **Occurrence of Red Coffee Borer,** *Zeuzera coffeae* **Niet., on Sea-Island Cotton at Pattambi (S. Malabar).**—*Indian J. Ent.* **18** pt. 2 pp. 195–196. New Delhi, 1956.

Zeuzera coffeae Nietn., which has a wide range of food-plants and has been reported from tea and coffee in southern India, was observed in November 1955 attacking Sea Island cotton, which had recently been introduced on the west coast of Madras. The larvae bored in the main stems and caused the leaves and shoots to wither. Only small numbers of plants were attacked, but it is feared that the Cossid may increase in importance if neglected.

NARAYANAN (E. S.) & BHAMBHANI (H. J.). **Effect of reduced Pressure on** *Tribolium castaneum* **Herbst (Tenebrionidae: Coleoptera) and** *Trogoderma granaria* **Everts (Dermestidae: Coleoptera).**—*Indian J. Ent.* **18** pt. 2 pp. 196–198, 6 refs. New Delhi, 1956.

In the course of investigations in 1949 on the vacuum fumigation of insects, it was found that subjection to an absolute pressure of 4·5–5 cm. mercury for three hours resulted in complete mortality of adults of *Tribolium castaneum* (Hbst.). Further tests were therefore made of the effect of such pressures on adults of *T. castaneum* and larvae of *Trogoderma granarium* Everts, reared on wheat flour and wheat grains, respectively, at 78–86°F. and 40–60 per cent. relative humidity and provided with the same foods at the same temperature and 50–54 per cent. relative humidity after treatment. The adults were 4–6 weeks old, and the larvae in the fourth or fifth instar, and they were weighed before and after treatment for determination of water loss; mortality was assessed on the fifth day after treatment.

Exposure of *Tribolium* to the low pressure at 92–95°F. for 15, 30, 60 and 135 minutes resulted in 14·3, 20, 34·6 and 49·3 per cent. loss of water and 12, 48·7, 82 and 100 per cent. mortality, respectively, and exposure of *Trogoderma* for 1, 2, 4 and 8 hours in 2·8, 5·7, 10·1 and 30·8 per cent. loss of water, and 0, 0, 0 and 36 per cent. mortality. It is concluded that mortality was mainly due to desiccation and that the treatment should be tested on a large scale against *Tribolium* and other susceptible insects.

KHAN (M. Q.) & MURTHY (D. V.). *Dicanthium annulatum* **Stapf.—an important alternate Host Plant of Jowar and Sugarcane Mites.**—*Indian J. Ent.* **18** pt. 2 pp. 198–199, 3 refs. New Delhi, 1956.

Oligonychus (*Paratetranychus*) *indicus* (Hirst) is a pest of sorghum sown in October and of sugar-cane planted in October–January in the Nizamabad District of Hyderabad State, and sugar-cane there is also infested by *Schizotetranychus andropogoni* (Hirst). *O. indicus* does not attack the plants until after the end of the south-west monsoon rains, and both mites were found to occur on *Dichanthium annulatum* during the rainy months of June–September. All stages were observed on this grass, even during the heaviest rains, which may indicate that it is the main food-plant of the mites.

KHAN (M. Q.) & RAO (A. S.). **The Influence of the Black Ant** (*Camponotus compressus* **F.**) **on the Incidence of two Homopterous Crop Pests.**—*Indian J. Ent.* **18** pt. 2 pp. 199–200, 2 refs. New Delhi, 1956.

In 1953–54, six varieties of sorghum growing in plots in Hyderabad were found to be infested by *Peregrinus maidis* (Ashm.) (*Pundaluoya simplicia* Dist.); 33–181 eggs were laid per leaf, and nymphs and adults were observed on leaves, leaf-whorls and leaf sheaths. When the flag-leaf was infested, it adhered to the ear and interfered with grain development. Among plants in plots that adjoined a bund harbouring nests of *Camponotus compressus* (F.), the percentages attacked were 74·3, 65·7, 49·5 and 30·2, whereas among those further away, they were 33·7, 14·9 and 11. All plots but the first were dusted with 5 per cent. DDT, which gave effective control of both the ant and the Delphacid, and a month later, the corresponding percentages of plants infested were 87·4 (after no treatment), 39·6, 12·7 and 17·8 and 1·2, 0·58 and 0. Infested plants showed ant nests at the base, enclosing the stem, and the roots and stilt roots were badly clipped, so that the plants lodged readily and finally dried up.

In July 1956, 16 nests of the ant were found outside the eastern border of a plot of groundnuts grown in sandy loam soil, and 96–100 per cent. of the plants were infested by *Aphis craccivora* Koch in a 10-foot strip along this border. Infestation decreased steadily with increased distance from the border to 3 per cent. at a distance of 36–40 ft., and there was none beyond this. Ant nests were numerous in the first 20 ft.

VASUDEVA (R. S.) & SAHAMBI (H. S.). **Phyllody in Sesamum** (*Sesamum orientale* **L.**).—*Indian Phytopath.* **8** pp. 124–129, 4 figs., 5 refs. New Delhi, 1955.

A phyllody disease of sesamum (*Sesamum orientale*), in which the floral parts are transformed into green, leaf-like structures followed by abundant vegetative growth, causes serious losses of the seed crop throughout India.

It was shown in experiments here described to be caused by a virus transmitted by grafting but not through the seed. Insects are numerous on the crop in the field, and in tests in which populations were collected from naturally infected plants, re-fed for a few days on diseased sesamum plants and then liberated on healthy plants in an insect-proof house, infection was transmitted by *Deltocephalus* sp., the symptoms appearing 33–59 days after the beginning of test feeding, but not by three other Cicadellids or *Bemisia tabaci* (Gennadius).

Distribution Maps of Insect Pests.—Series A, nos. 79–84. London, Commonw. Inst. Ent., 1957.

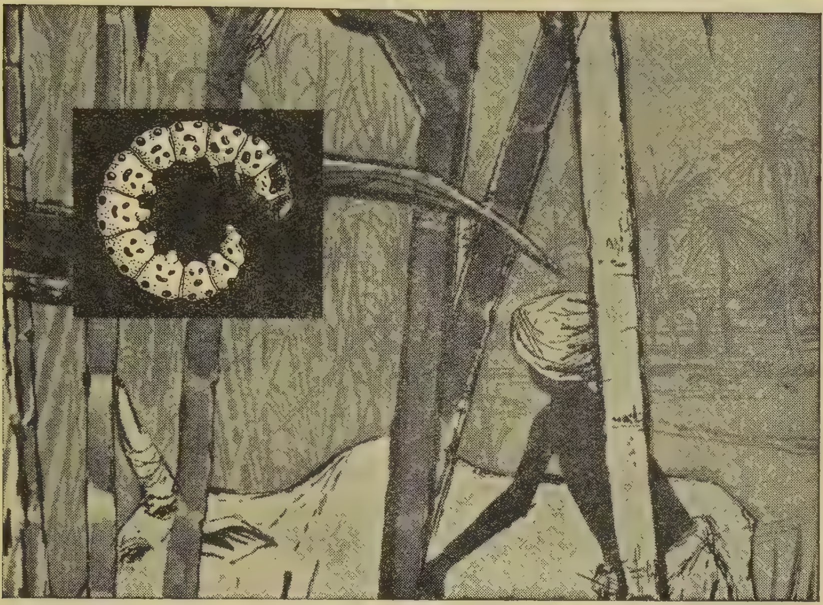
These maps are nos. 79–84 of a series already noticed [*R.A.E.*, A **40** 203; **45** 290] and deal, respectively, with *Forficula auricularia* L., *Howardia biclavis* (Comst.), *Aonidomytilus* (*Lepidosaphes*) *albus* (Ckll.), *Austrotortrix postvittana* (Wlk.), *Hylemyia brassicae* (Bch.) and *Psila rosae* (F.).

PAPERS NOTICED BY TITLE ONLY.

METCALF (R. L.). **Physiological Basis for Insect Resistance to Insecticides** [a review article].—*Physiol. Rev.* **35** no. 1 pp. 197–232, 2 figs., 191 refs. Baltimore, Md., 1955.

DAVATCHI (A.) & TAGHI-ZADEH (F.). **Les insectes nuisibles au cotonnier en Iran.** [*In Persian.*]—*Ent. Phytop. appl.* no. 15 pp. *3–46*, 17 figs. Teheran, 1955. (With a Summary in French, pp. 1–13, 5 refs.)

DOWNING (R. S.), MORGAN (C. V. G.) & PROVERBS (M. D.). **List of Insects and Mites attacking Tree Fruits in the Interior of British Columbia.** —*Proc. ent. Soc. B.C.* **52** (1955) pp. 34–35. Vernon, B.C., 1956.



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